JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

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EDITORIAL NOTES—GAS, &c.

The Session's Gas Affairs.

THE prorogation of Parliament is fully expected to take place to-morrow. To the labours of Parliament the gas industry has not, during the session, contributed heavily. Possibly the attitude of the present dominant party of the House of Commons towards private enterprise, and the ultra-socialistic tendencies of a section whose behests are treated with servile respect, and whose actions and inflammatory words, however much opposed to law and order, go unreproved, have had some weight in the considerations which have induced Gas Companies to defer further appearance at Westminster. Suspensory clauses and other tokens of municipal patronage by the heterogeneous party in power are not calculated to give confidence that private measures will receive judicial handling. But the worst fears formed during the first session of the new Parliament have been mitigated during the second, by the menaced violent trampling down of private interests in pursuance of a policy having been checked before it could develop to actuality, and not only by the House of Lords but by the ratepayers. The Upper House stands for protection in these times, as we have witnessed in the case of the Bill of the Hull Corporation for despoiling the East Hull Gas Company of their property. And the ratepayers have proved their position and title to checkmate the tender regard of the followers of the Government for, and the submissiveness of the latter to, municipalization, in the case of the Merthyr Tydfil gas purchase proposal, and by the decisive vote in London that sounded the death-knell of the ambition of the Progressives to take under their capacious wing the electricity supply of the Metropolis and of territory a distance beyond. The only way the Government can now endeavour to help the Progressives is by the promotion of a Government measure for the purpose (it is suggested that gas and all other public services might be embodied in one); but if this were done, the Government would provoke such an outcry from the overburdened Metropolitan ratepayers, that we venture to think, strong as the Government are in the numbers of their following, they would hesitate to pursue the matter to the extreme end. The Premier has promised to do something before the end of the life of his Government, on the vague condition that there is unity. But he has delayed action by not promising anything for the session of 1908. When, if ever, the time arrives, the House of Lords and the ratepayers of London will not be found wanting.

Meantime, with the exception of the farcical decision of the Police and Sanitary Committee on the gas section of the Hull Corporation Bill, it must in fairness be said that, in the small amount of work the Select Committees were called upon to perform in connection with gas measures during the session, there has not been anything to complain about; and, as a matter of fact, their work has contained several commendable features—one particularly noteworthy being the refusal of the Police and Sanitary Committee to allow the Hull Corporation, by their private measure, to transgress the long-established principle, under the Lands Clauses Acts, of an allowance for compulsory purchase. This decision and one by another Committee, passing the Bill of the Worthing Gas Company for acquiring a site for new works at Goring, raised the question in the House as to the expediency of the House interfering with the judgments of Select Committees, in view of the mischievous effect it would have in debilitating responsibility and authority. In neither case would the House interfere; and the subtlety of the Hull Corporation in playing upon the anti-private-interest string availed them nothing in trying to create a precedent in a Private Bill for no allowance for compulsory purchase. The joy of their success in the Commons, however, in getting their purchase powers passed, was short-lived; for a few weeks later a Select Committee of the House of Lords found that the Corporation case for purchase was, as had been manifest throughout to all disinterested observers, so deficient in substance that it was incapable of standing to meet the case of the Company, and so they suffered it to collapse. It was a most undignified ending; but we hope a wholesome lesson has been administered by it to grabbing authorities. As a consequence, we are still in the position of having no precedent of a measure for the compulsory purchase of a statutory gas undertaking that has been contested through both Houses, excepting the one of Pontefract in 1906, in which the Chairman of the Committee fairly expressed the position when he said there was not in that case a clear line, but it was felt by the members of the Committee that there had been want of enterprise on the part of the Company. However, whatever the Commons are prepared to do, the House of Lords have declared they will not have such forced sales of statutory concerns unless there is plain proof of lethargy and of unfaithfulness to the trust reposed in the companies by Parliament. This Hull Purchase Bill alone has made the expiring session notable for gas supply; but the efficacious value of suspensory clauses in supporting the cause of gas-works purchase must have declined considerably in the eyes of municipal authorities, since the ratepayers of Merthyr resented the forwardness of their local authority, and the House of Lords ignominiously rejected the Hull proposals.

Altogether, there were not more than twenty measures dealing in any way with gas supply before Parliament this session; and but a small proportion were discussed before Select Committees. In nearly all instances, at the start of the session, petitions were lodged against the Bills; but in most cases opposition was withdrawn on further investigation into the provisions, or on agreement. The Removal of Sulphur Restrictions Bill was accepted as inevitable and as above attack by the local authorities concerned. Next to the Hull Bill, the Worthing Gas Company's Bill claimed a liberal amount of interest, owing to the strenuous and successful defence the Company made of their choice of a site for new works, against the enraged attacks of interested landowners at Goring, who left no stone unturned in their effort to do mischief to the public interests, in order that their individual interests should not suffer the harm that only exaggerated notions had created. The Annfield Plain Bill also got through, though subjected to a vigorous opposition. Mention of this measure reminds us that the Lord Chairman would not allow the promoters, nor those of the Llandrindod Wells Gas Bill, the little latitude enjoyed by the Metropolitan Companies, and more recently by the South Suburban Company, of a ½-candle margin below the standard illuminating power before becoming liable to a penalty. Illuminating power and testing have now got into a definite channel, in which channel the gas industry can for the time being afford to stop. Fourteen candles, though a few companies have managed to secure sanction to 13 candles, is the common illuminating power standard present; and the Metropolitan No. 2 burner and the 10-candle pentane lamp are the approved standards for testing. The new testing conditions have withstood the assaults of the few, made with narrow front and purpose, and without success. Had they been successful—there was no anticipation they would ever be, except possibly in their own minds—their work would have had the effect of restricting the industry's opportunities, for the widening of which time and money have been expended lavishly. The Board of Trade have declined to interfere with a fair and acceptable standard of testing the various qualities of gas commonly supplied; and now those who are working under anything but the new method are well behind the times. It has been occasionally found that in the drafting of Bills a little mixture of the old and new provisions affecting testing are inserted—through, we suspect, some misapprehension. Such a case occurred in the Twyford Order this session, and was referred to in

the editorial columns on Jan. 15. In the confirmed Order, the superfluous testing conditions appearing in the original have given place to the model form of clause. In the Mitcham and Wimbledon Bill, the South Suburban clause has been incorporated for testing for calorific power and by flat-flame burners for information only, and distinct from the penalty test with the Metropolitan No. 2 burner. We cannot see any possible value in multiplying these tests, and imposing more labour on gas examiners. There may be an idea lurking somewhere or other that the day will come when the information thus being gathered under different conditions may be useful in getting imposed a double test, or in deposing the illuminating power test for a calorific power one. Touching this testing question, the King's Norton and Northfield District Council were unsuccessful in inducing Parliament to destroy a parliamentary bargain whereby Birmingham supply gas in their area having a standard illuminating power of 15 candles. The Council asked for a testing-station of their own at a place not exceeding five miles distant from Birmingham. What that would have meant for the Birmingham Gas Department, in the way of increasing the cost of production through enrichment, can be imagined, if not readily estimated.

The above are perhaps the principal features of the gas measures of the session; but we know that between Draft Bills and Royal Assented measures many changes in detail have been effected. Notice of these, however, can wait until we have before us prints of the Acts, which can be brought into comparison with the original Bills.

Capital Indebtedness and the Consumer.

Before the beginning of the recent controversy in our "Correspondence" columns respecting the relative capital indebtedness per unit of output of Local Authorities and Gas Companies, Mr. Norton H. Humphrys, it now appears, had been incited by a sentence in the Presidential Address of Mr. Charles Hunt to the Institution of Gas Engineers to make a somewhat detailed study of the matter. The moving sentence was: "It must be apparent to all that, in their "treatment of capital charges, the local authorities have "been wise in their generation, and that their position in "years to come is likely to be a much stronger one than "that of the companies." If we may judge of the future by the commercial test provided by the past and the present, the process of attaining the "much stronger position" is unkindly slow, notwithstanding the advantageous situation of the major part of the gas-supplying local authorities. After reading carefully the account of Mr. Humphrys' investigation into the subject, the conclusion must be drawn that condition does not permit of any equal comparison being made, and therefore the greater the unfairness of presenting figures besmirching the capital management of the companies as a whole. It would be *ultra vires* for the companies to attempt to whittle down capital expenditure per unit of output in the manner that the local authorities, working entirely on borrowed money, are statutorily compelled to adopt; the process of reduction in the case of companies being of a much slower order. And, as a matter of fact, the method of redeeming capital by a compulsory sinking fund could not be applied to numerous undertakings in residential districts without doing immense injury to the consumers. The smaller municipal electricity undertakings have proved this not only by the hardship imposed on the ratepayers and by a continual struggle for life and solvency, but by the production of offences against legitimate finance, with the object of presenting a brighter aspect. "There "are more things in heaven and earth, Horatio, than are "dreamt of in your philosophy," or taken into account in the basis of your warnings.

From the primary capital condition existing throughout geographical and internal circumstance, gas companies, regarded as a body, are placed in a position totally different from that of the local authorities. As Mr. Humphrys shows, the consumers of the past and present generation in the case of gas companies are in no wise worse off, but rather better off than they would have been under the conditions of municipal administration. There is no reason why, given the excellent districts possessed by the majority of municipalities, company administration—relieved of the necessity of providing sinking funds and contributions to the rates demanded by grasping local legislators (and which contributions have shown no signs of diminishing since local government has incorporated strong-lunged demagogues of faction)—should not have done much better than the municipalities for the consumers in those districts. As Mr. Humphrys says, the position of the major part of the companies is in no sense a reproach to them. Their service has been and is excellent; and the consumers have nothing to complain about, as they have under municipal management by being the victims of indirect taxation, which can only be avoided by adopting means of lighting and of heating that are not under municipal management. It is admitted that all that is done towards reducing capital expenditure to-day should be to the advantage of the gas consumer of to-morrow. But, in the case of municipal administration, let the capital be reduced to its narrowest possible limits by a full respect for the sinking fund, and there are those sitting in the seats of the local mighty who will see to it that the gas consumer is not the greatest beneficiary. For the consumer, the steady easing-down of capital per unit of output on the part of the companies will possibly work a better result.

Gas Cooking and Heating Business—Workmen's Compensation.

The Directors of the Liverpool Gaslight Company, through their Chairman, Mr. H. Wade Deacon, continued the tale of prosperity of the concern at the meeting of the proprietors last Tuesday. The consumption of gas during the year increased by 2¼ per cent., in spite of the keen competition for private business of the municipal electricity undertaking; and the receipts from sales of gas increased by £12,835. Residuals, too, yielded their contribution to the balancing of higher expenditure, with £8000 additional for coke, and £4000 additional for tar, against which had to be set only £670 decrease on the income from ammoniacal liquor. The outlay on coal, through greater consumption and heavier price, was higher during the year; and the Directors, having now made their contracts for coal for the ensuing year, have knowledge of an extra expenditure of £30,000 (which is equal to 2d. per 1000 cubic feet of gas produced) under this head for the current twelve months. This brings us to a most important point in the meeting, which was the announcement that—notwithstanding this known great increase in expenditure, and the fact that only £6000 is carried forward after meeting interest and dividend—for the Company's high illuminating power gas the price is not to be altered, and this 2s. 6d. is the lowest price at which gas has ever been distributed for ordinary purposes in Liverpool. It is frequently charged against gas companies that they have no conscience for anything but their own interests; but here is a Company—an illustration of many others—paying barely 4½ and 4¼ per cent. at present market prices of their "A" and "B" stocks, who, though the struggle will be a tight one, are going to take the risk for the present of not reinforcing their finances by an increase in the price of gas. It is a wise policy, up to a point; and the Directors of the Company may be relied upon to distinguish when that point has been reached. We have no expectation, consequent upon this determination, that anything will be heard from the consumers as to the Company having been "fleecing" them aforetimes. On the contrary, one of the leading local papers, in an editorial article, prominently recognizes that the Directors will have to strain every nerve to keep the price down; and there is a note of gratification over their decision running all through the article.

There was a time when, on a considerable increase of the cost of coal, gas consumers were hit much worse than they are to-day; for whereas the dearer gas was being consumed at a greater rate—probably 12 to 15 cubic feet an hour in an ordinary living room—a superior illumination can now be obtained by consuming 3½ to 4 cubic feet an hour in an incandescent burner. Accompanying this fact, consumers should bear in mind, in these times of high-priced solid fuel, the considerations of saving in labour, convenience, and economy of gas, where the price is reasonably low, in cooking and heating through the facility of immediate lighting and extinguishing. There are no (what shall we call them?) "stand-by" charges and losses as in the case of a fire fed by solid fuel. This is a point of which sight is frequently lost. The managements of gas undertakings, prompted by their commercial enthusiasm, will look to their future interests by making the best possible use in the present of the high prices of solid fuel. We notice, in a special article on dearer coal

in the "Daily Telegraph," that one dealer is predicting that, in the coming winter, the price of household coal will return to the high level of 1900, when certain qualities touched 35s. per ton. But another retailer only anticipates a further rise of 1s. Anyway, household coal prices are quite high enough now to make the user lend a readier ear to representations that advantage him as well as the local gas undertaking. The electrical industry is not oblivious to the opportunity. They are lamenting the prospect of reduced consumption through the new high-efficiency lamps; and, in addition to the plans for reviving the campaign for the capture of prepayment consumers, the advice is given that now is a favourable opportunity for the "advantages" of cooking and heating by electricity—of which advantages economy is not one—to be sedulously propagated.

A matter that is agitating the administrations of gas undertakings as large employers of labour is the expansion of the risk under the Compensation Act which came into operation on July 1, and the extraordinary views of the insurance offices. The Directors of the Liverpool Gas Company have, like several other important concerns, after carefully considering the whole bearings of the question, decided that the Company shall take up the risk themselves. To prepare against it, they have set aside £1000 to form the nucleus of a fund. This is a big percentage on the Company's wages bill—more than the South Metropolitan Company, Sheffield, Edinburgh, and other administrations consider necessary. It is prudent to have a fund in hand, and a substantial one as early as convenient; and contributions can at any time be lessened when it is considered that the fund is at a point sufficient to cover any possible or serious contingency. With the decrease in carbonizing wages brought about by modern plant, upon which the Company have been spending largely out of revenue, the provision for compensation will not be a burdensome matter. But what large concerns can do in this matter of provision and self-protection under the Act cannot be as easily undertaken by concerns of the smaller magnitude, employing considerably less labour.

The Need of the Illuminating Engineer.

In an article on "Illumination" in the Engineering Supplement to "The Times" last Wednesday, Mr. Leon Gaster deals once more with a subject with which he has identified himself—viz., the need of men who are willing to devote themselves to the systematic application of the scientific principles of artificial illumination, or, in other words, "illuminating engineers." He points out that good illumination involves three essential points—the right quantity and the right quality of light, and the right use of it. For a proper understanding of these three prime conditions one has to be specially trained. He considers that in present practice illumination is left too much to mere chance, it being nobody's business to look after it. Once the installation is finished, the work and interest of the contractor cease; and the use—or rather the abuse—of the light is left to the inexperienced consumer, without possessing any knowledge of how to use it in the most economical manner. Mr. Gaster says the important *rôle* this new specialist will have to play in the near future may be better understood if it is mentioned that the expenditure for lighting in this country is estimated to exceed £36,000,000 per annum. To make a conservative estimate, about 10 per cent. could, in his opinion, be easily saved by properly looking into this matter; so that £3,600,000 could be turned to better advantage, and more satisfactory illumination be obtained.

Explosions in Electric Light Culverts.

The question of liability for explosions on occasions when an escape of gas is fired by another escape in the shape of a fused electric wire, is a matter upon which there has been endless discussion without any apparent result. An interesting explanation of these explosions has been given by Dr. H. Bassett in a paper read before the Liverpool Section of the Society of Chemical Industry, some extracts from which will be found in another column. The author directed attention to a case in which metallic potassium and sodium were produced by the escape of electricity from a subterranean cable of which the insulation had become defective. The leakage occurred at a point where the negative cable had been joined; and the electrolysis of the surrounding water, containing potassium and sodium salt, had resulted in the production of a liquid alloy of the two metals, either of which will burst into flame if brought into contact with water. As during the electrolytic process considerable quantities of hydrogen must have been formed, all the materials for an explosion were present. Dr. Bassett expressed the opinion that many of the explosions in connection with electric light mains which are attributed to coal gas are very possibly really due to "hydrogen formed by electrolysis." This opinion, as Dr. Bassett acknowledged, is only a reiteration of a suggestion first put forward by Mr. G. F. L. Foulger nearly twelve years ago, on the occasion of the inquiry by the Board of Trade into the explosion which occurred in the conduit of an electric light main in the Euston Road. The facts cited by Dr. Bassett make it all the more necessary that the causes of these explosions should be thoroughly investigated.

"Gas Used on Works."

This is an item in the statement of gas made, sold, &c., that covers a number of legitimate uses on a works, and occasionally it has been known to carry more than its fair burden. In many works now, electricity generated by gas-engines is used for driving plant. This is the case at the Bournemouth gas-works; and it is not considered fair by the Directors and officials of the Company that the item "Gas Used on Works, &c.," should bear this additional use without proper recognition and charge. Therefore, in the statement of gas made, sold, &c., the common phrase has been altered to "Quantity used on works for Light and Power." In the revenue account, under "Manufacture of Gas," there is a charge "Sundries at Works, including Power Gas," £999; and on the opposite side of the account under sale of gas is the credit "Power Gas on Works, £409." This is a practice that Mr. William Cash, the Secretary of the Company, hopes will be followed by other gas companies wherever gas power for works' purposes is largely used.

Hot-Water Circulating Systems.

The Gaslight and Coke Company have taken up the gas hot-water circulators with much energy and success; and in many other quarters the system has attracted attention, and has been the subject of comment at meetings of shareholders. Mr. G. Crispe Whiteley, the Chairman of the Bournemouth Gas and Water Company, is a great believer in the future of this system of water heating and circulation throughout a house. The convenience and the comfort afforded are so great that the circulators are bound to advertise and commend themselves; but they want a little pushing, just as the gas-cooker did at the start. In Bournemouth there are sixty hot-water circulating-boilers using gas now installed; and the Chairman asks for reasons why, if 60, there should not be 600, and if 600 why not 6000. The only answer we dare to suggest to him is that there is the cost of the installation and the derangement of a dwelling while the fitting up is proceeding. It is not quite such a simple matter as the installation of a gas-cooker. But the Bournemouth Company have made a good record in the matter of getting out cookers. They have 18,500 householders in their district; and there are 14,000 cooking-stoves fixed. In face of this, we look for a large increase in their area of gas-heated water-boilers; but expectations cannot rise quite to the heights suggested by the Chairman.

The Business Side of Engineering.

In the course of an article on this subject in the Engineering Supplement to "The Times" last Wednesday, Professor Ayrton directed attention to the fact that the collegiate teaching of engineering in this country usually excludes one of its most important branches—the business side, as distinct from the purely scientific and technical sides. He attributed this partly to a feeling that the application of the principles of business can only be learnt in the office, and partly to an impression—the correctness of which he readily admitted—that a shrewd business man, like a poet, is born, not made. He went on to point out that while the practice of our forefathers was to make an engineer of a lad by putting him straight into works on leaving school, we now send him to a technical school or college, to learn the application of mathematics and science to engineering, under teachers of these subjects. "Why not, then," he asked, "teach the principles of business in these colleges, instead of leaving the budding engineer to stumble on them by trial and error—chiefly error—when he is actually

engaged by some firm of engineers?" In this respect, as in some others, our American cousins are in advance of us, inasmuch as in certain of the engineering colleges in the United States great attention is given to the business side of engineering. For example, as Professor Ayrton mentioned, it is the "Professor of Business Engineering" who is the President; and he, as our readers are aware, is Dr. A. C. Humphreys, of Messrs. Humphreys and Glasgow. In the course of a conversation the President had with Professor Ayrton, he told him that he was chosen by the Trustees to preside over the College "because he was a successful man of affairs;" and it appears that he divides his time fairly equally between the science and the practice of engineering. His mornings are devoted to his collegiate work, and his afternoons to the affairs of the important firm with which he has been for so long associated, whose plant, as our advertisement pages testify, is to be found all over the world. Probably a better example of the advantageous combination of engineering skill and business capacity could not have been selected to emphasize the writer's point. Doubtless the combination is rare; but, on the other hand, it may exist to a greater extent than is supposed, and only await development. Professor Ayrton is therefore deserving of thanks for his suggestive article.

Uniform Gas Prices at Vienna.

The authorities of the Vienna Municipal Gas-Works have recently decided, according to "Gastechniker," to abolish the differential rates they formerly charged for gas, in favour of a uniform selling price. Hitherto the charge for lighting gas has been 19 heller per cubic metre [at the current rate of exchange, 24 k. being equal to £1, equivalent to about 4s. 6d. per 1000 cubic feet], and that for heating and power 14 heller, or 3s. 4d. Now the rate is fixed at 17 heller or 4s. per 1000 feet for all purposes. In consequence of the change, it has been decided to abolish the discount formerly accorded to consumers who used more than 200,000 feet per annum for lighting purposes; but to give industrial consumers discounts ranging from 5 to 15 per cent. if their total consumption exceeds 350,000 feet. The institution of the fixed price also involves a reduction of about 6d. per 1000 feet in the price of gas when supplied through slot meters. It is believed that the change will cause a reduction in the bills payable by 80 per cent. of the consumers, will increase those payable by about 10 per cent., and will leave the remainder practically unaffected. Inasmuch as the 80 per cent. are largely made up of small traders and persons who work in their own homes, it is considered that the alteration will benefit the general public. The advantage to the gas undertaking is, of course, obvious, as it reduces the number of meters at work, simplifies the connections that have to be made in fitting up new premises, and diminishes the amount of book-keeping requisite.

Scottish Junior Gas Association (Western District). — The "Transactions" of the Western District Section of the Scottish Junior Gas Association for the session 1906-7 have been issued in book form. The volume extends to 72 pages, and contains the papers read before the Association during the past winter, with the discussions upon them, reports of the visits paid to works, lists of the members, the accounts, and the photograph of the members taken at the fire-clay works of Messrs. James Dougall and Sons, Limited, Bonnybridge, on the occasion of the visit of the members in January. The annual report of the Council is also given, in which it is stated that the membership numbers 123, consisting of 110 ordinary and 13 honorary members; and also during the year the Council purchased fourteen books on gas manufacture, which they presented to the library of the Glasgow and West of Scotland Technical College. At the end of the third session, there was a balance in hand of over £23.

Assessment of Compensation under the Lands Clauses Act.— Questions of some complexity frequently arise as to what are proper matters for compensation in respect of land acquired compulsorily by statutory companies and public authorities under the Lands Clauses Act, 1845; and in a pamphlet by Mr. R. A. Gordon, M.A., LL.M., of the Inner Temple and the South-Eastern Circuit, the principles on which this right to compensation is based are discussed. The subject was chosen by the author for treatment when going up for the degree of LL.M. in the University of Cambridge. The matter is divided under two headings—(1) compensation where land is acquired compulsorily for the purpose of a public undertaking; and (2) compensation where no land is taken, but is injuriously affected by the construction of authorized works. Under this heading the author points out that the damage or loss must be the result of an act made lawful by the statutory powers of the promoters; and he cites the case of *Broadbent v. Imperial Gas Company*, which will be within the recollection of some of our readers, in support of the statement that if a statutory company extend their powers and cause damage to a proprietor's land, his redress is by action, and not under the Lands Clauses Acts. The pamphlet is being published by Messrs. Butterworth and Co., at the price of 1s. net.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 593.)

THOUGH not uniformly good throughout, last week's doings on the Stock Exchange were an improvement on its predecessor, and certainly left the position better than they found it. It was a short week, too—the Exchange being closed for a holiday on Saturday; and this brought about something of an increase in the Friday realizations and their consequential lowering effect. But for this, the tone at the finish might probably have been better than it actually was. The opening was anything but good. Movements were shifty and irregular; but the prevailing tone was decidedly dull. One small failure did not help to infuse cheerfulness. Tuesday was a very flat day. There was some renewal of disquieting realization; and almost every market was depressed—South African being conspicuous in this respect. The gilt-edged division—one of the chief sufferers lately—was, however, inclined to look up. On Wednesday, a brighter state began to dawn. Influenced by the Wall Street tone, a recovery manifested itself; Consols and Home Rails being well to the front. This improvement was fortified on Thursday. Selling seemed to stop; the pendulum began to swing the other way; and buying was more the order of the day. The fact of the Bank Directors making no further advance in the rate was a relief to those who had been fearing another rise. Consols rose ¼. Business was very quiet on Friday; but the general firmness was slightly impaired by some closing of accounts, which took a little off the advance that Consols and Rails had made the day before. In the Money Market, there was a fair demand for loans at pretty easy rates; and discount, which had opened firm, was much easier before the close. Business in the Gas Market was not so bad for the time of year; but the great bulk of it was in the chief issue. The tendency was quite steady; prices on the London market being unchanged. Gaslight and Coke ordinary was rather active, and changed hands at steady figures ranging from 92¾ to 93¾. In the secured issues, nothing was touched but the preference, which marked 104 and 104½. South Metropolitan was very quiet, with two bargains at 119¼ and 118½. The debenture was done at 82½. Commercials had only one deal in the 4 per cent., at 106½. The Suburban and Provincial group were quite quiet. Bournemouth "B" was done at 17, Brentford new at 187, and West Ham debenture at 100. On the local Exchange, what is there called an "odd lot" of Newcastle debenture was let go at 90, which put the price down. In the Continental Companies, Imperial marked 173½ to 174½, ditto debenture 91½ and 92, Union 114, European fully-paid 22⅛ and 23, ditto part-paid 17¾, and Malta 4¼. Among the undertakings of the remoter world, Melbourne 5 per cent. was done at 101⅛, Oriental at 143½ and 144, and Primitiva preference at 5⅛.

ELECTRIC LIGHTING MEMORANDA.

Coal and Costs—The Peak-Load—Reduction of the Average Horse-Power Connected at Bradford—Insurance and Accidents to Machinery—Ignoring One Party to a Contract.

THE electrical papers have not taken much notice of the question of the increase in the price of coal, and of the influence it will have upon works' costs, upon the price of electricity, and upon the net profits of electricity undertakings. Coal is the heaviest element in works' costs; and therefore the increase in its cost will be a serious matter. At West Ham the coal bill has been heavier by £2580; and at Newport (Mon.), by some £1200. At Derby, just recently, the Chairman of the Corporation Electricity Committee stated that the department had had to pay considerably more for coal than they did last year; and this would entail an increased expenditure of about £1000 a year. We do not think Derby can afford to shed so much without having a deficit, as the "Electrical Times" tables show that the department only took credit for £134 of net profit in the year to March, 1906. The local authority of Sleaford have also been bewailing the additional expense that will fall upon their little struggling concern. But, speaking generally, the price of electricity for power and "heating" business has been cut very fine; so fine that the slightest wavering in expenses in cases produces loss. Most undertakings, too, can point to installations the intermittent and short-hour load of which invariably contributes, at the prices accepted, to loss and not to gain. We shall expect twelve months hence to see many additions to municipal electric accounts with deficits which will show how close in the matter of prices electricity undertakings have been cutting to get any business. While mentioning coal, attention may be drawn to a scheme in vogue at the Cheltenham electricity station, for rewarding the men for savings of coal. The night shift has been having a bonus of 2s. 6d. per cwt. saved for every 1000 units generated; and so satisfactorily has this worked that the bonus is to be increased to 5s.—the extra 2s. 6d. being equally divided between the day and night shifts. In the four weeks ending July 8, the saving in coal was valued at £11 17s. 2d.; and the men received by way of bonus on this £1 16s. 7d., which left a net saving of £10 0s. 7d. to the department. It is a very profitable way of encouraging greater interest among the men in their work, and of teaching them the value of economy.

Our friends of the "Electrician" have had an editorial on the subject of the peak-load in electricity supply. The peak-load is always regarded as that which is the most costly to meet; and for the matter of that the lowermost depression in the load curve supply a decent second. Of course, it is a good thing to level down the peak as much as possible; but it must not be forgotten that, with any system of lighting, there must always be more or less of a peak, and that the peak in the case of a town electricity undertaking is a protuberance from the load that brings in more revenue than any other, and without which load the electricity undertaking would not be able to partially fill in its valleys with a miscellaneous business, a portion of which is of a character in lightness and duration that does not pay, so the station engineers find out, at the prices at which it has been taken on. Our contemporary says that, though on most electricity supply networks, the peak-load does not assume such an important position as it did some years ago when the remainder of the load was practically unimportant, it still takes up an unpleasantly prominent position on most load curves, and receives attention from time to time in the Technical Press as that part which is more or less undesirable. "It is looked upon as the part of the load which is the most easily obtained, and the part which is the least profitable. In a sense this is so." But it must not be overlooked that this peak springs from the load that produces the greatest income; it is a sort of necessary evil, and so must be taken as part and parcel of the load, and not as something distinct. Another point in our contemporary's article is:

> The charge for a lighting load must always be heavier than that for a load which is maintained for longer hours. There must necessarily be a difference in price; the only objection to having such a properly proportioned price is that the consumer of light for short periods feels aggrieved that he should not get it at a very low rate. That there should be a difference in price at all is a point which our gas friends generally find difficult to grasp, simply because in the manufacture of gas a means of storage on a large scale is commercially possible, and the question of a peak-load does not come into account.

Our contemporary misjudges. We have no difficulty in grasping the necessity for differential prices; they exist in the gas business as between on the one hand industrial uses and on the other lighting, heating, and cooking. But what we do not appreciate is why any day electricity consumers should be taken on whose business at fine prices it would be more profitable for an undertaking to be without, as was shown some time since by the "Electrician" in a series of articles dealing with power supply in London, and by papers at the last meeting of the Municipal Electrical Association, in which the speculative fixing of charges was condemned (*ante*, p. 218). Gas power consumers are taken on, but not at prices below the average cost of the gas per 1000 cubic feet; and there is in most cases, except for specially large business, uniformity of price for gas used for lighting, cooking, and heating. But when we see such wide differences as (say) 0·60d. or 0·75d., for electricity power business, and 1d. for short time heating and power business, in the valleys of the curve, and 4½d., 5d., and 6d. for lighting business, the backbone of the undertaking, we cannot admit that the full extent of the obligation of the undertaking to the lighting consumer is being recognized. The railway companies have lately been grumbling about their revenues. Perhaps if they took a leaf out of the book of laws governing electricity undertaking charges, and increased their fares at the times of the peak-loads of suburban traffic—say, from 8 to 10 a.m., and 4 to 7 p.m.—and reduced the fares considerably in the intervening valleys, they might —— well, we will not say what they might or might not do, but there would be an awful row.

The electricity power business does not appear to be extending towards the larger units; and long-hour users of power do not give any evidence of their fascination by this system of driving, from the point of view of economy. The Electrical Engineer of Liverpool some time since pointed this out; and now a report is to hand from Mr. T. Roles, the Electrical Engineer to the Bradford Corporation, telling us much the same thing. In that city, the output of electricity for power purposes has remained practically stationary since 1904; and generally the sale of electricity is not increasing to anything like the extent which could be expected or desired. A fresh scale of charges for power came into operation in the early part of 1904; and we may suppose that the revision was made for very good reasons. But what has been the result? While the average horse power of the motors connected gradually rose, up to and including March 31, 1904, from 3·5 to 5·1, since then it has gradually dropped to 4·8. This is a small average power; and it is conclusive evidence that in Bradford the higher horse-power motors are not growing in favour, and that only small ones are now being coupled up. Assuming that this is all due to the price charged, what Mr. Roles says shows that the price will have to come down considerably below 1⅛d. per unit to have any persuasive power, because, even at that price, "the larger consumers" have been giving up "taking a supply from the mains and installing their own generating plants or adopting gas-engines, operated, for the most part, by suction gas;" and they would not have been doing this, and taking upon themselves the additional labour, anxiety, and responsibility attaching to a plant of their own, if they thought there was any chance of the Corporation Department being in a position to supply them at an equally low rate. Short-hour consumers are being attracted and retained; but the long-hour ones are sliding off. Mr. Roles is therefore of opinion that the prices must, in the interests of the undertaking, now be revised, in order that he may have something to offer the long-hour users and large consumers, and at the same time place the less desirable users on a paying basis.

Affecting the question of power supply is that of the reliability of electrical machinery. The report for 1906 of the Chief Engineer of the British Engine, Boiler, and Electrical Insurance Company, Limited (Mr. Michael Longridge, M.A., M.Inst.C.E.), is now before us; and in it we find that there has been another large increase in the business of the Company's electrical department, which goes to prove that the insurance and inspection of this class of machinery by independent men is useful, and is appreciated. As compared with 1905, the number of dynamos and motors insured increased by 15 per cent., and the breakdowns "increased" in a somewhat lower ratio, both in number and cost. The Company are at a loss to know whether thanks are due to the makers of the machines insured for supplying better designs and workmanship, to the owners for exercising greater care, or to the Company's own inspectors; but probably all have contributed. Besides dynamos and motors, a very large number of motor-starting switches have been insured; but with them breakdowns have increased far more rapidly than the insurances, and the cost of repairs in a still greater ratio. The rate of breakdowns during the year among dynamos was 1 in 16, and among motors 1 in 8·2. The rate among continuous current machines, both dynamos and motors, was twice as high as among alternators; but the cost of repair per breakdown, was only about one-half. This is no doubt due to the relatively large size of the alternators. The proportions in which the various parts of the machines are thought to have caused or initiated breakdowns are tabulated. Taking the parts which it is believed failed first, the percentages to breakdowns are as follows: Armatures and rotors: Dynamos, 50 per cent.; motors, 44 per cent. Magnet coils and stators: Dynamos, 11 per cent.; motors, 14 per cent. Commutators and brush gear: Dynamos, 20 per cent.; motors, 28 per cent. Miscellaneous: Dynamos, 19 per cent.; motors, 14 per cent. Under the head of starting switches and controllers, the percentages are: Resistance coils, 48 per cent.; contacts and switch arms, 10 per cent.; automatic apparatus, 17 per cent.; miscellaneous, 25 per cent. The causes of the breakdowns were probably as follows:

	Dynamos. Per Cent.	Motors. Per Cent.	Starters. Per Cent.
Accidental	15	9	22
Dirt and neglect	14	19	11
Age and deterioration	21	25	23
Bad workmanship and design	23	18	9
Overloading	0	2	7
Unascertained	27	27	28

The peculiar question (referred to a fortnight since) that has arisen over the transfer of certain portions of the borough of Hampstead to the area of the Marylebone Borough Council, and consequently of the electricity consumers through the operation of the London Electric Lighting Areas Act, has again been before His Honour Judge Selfe. The electric lighting consumers transferred, it will be within recollection, had had no notification of the change, and when their accounts came in they discovered that, *nolens volens*, they were being charged double the 4d. per unit they had been paying the Hampstead Council. The question was raised in the "Memoranda" whether, although the Electric Lighting Areas Act authorized the transfer of the areas, it also continued supply contracts made at one price with the Hampstead Council and vested them at a higher rate in the Marylebone Council without any proper intimation being granted to one of the parties to the contract. His Honour Judge Selfe is sympathetic towards the consumers, although his opinion is that the Act in question not only gave the Marylebone Borough Council the same powers over the residents in the transferred districts as over the residents in the other parts of Marylebone, but that it also relieved the Hampstead Borough Council of its duties and obligations. Admitted; but it does appear to us that it is stretching the authority given by the Act to say that the relieving of the Hampstead Borough Council of its duties and obligations also empowered the Marylebone authority to take up a contract with a private individual and put into it (as it were) an enhanced price without proper notice, so as to enable the consumer to acquiesce or otherwise. For instance, one of the defendants had a contract with Hampstead for ten years at 4d. per unit; but suddenly and without warning he was transferred to Marylebone, and his account has been rendered at 8d. It is all a question of the interpretation of the extent of the power given by an Act. Leave to appeal has been granted; and His Honour is also not unwilling to reconsider an application for a new hearing, if Counsel considers that the whole of the facts are not in his (Judge Selfe's) possession.

It has been decided by the Paris Municipal Council to perpetuate the memory of Professor Berthelot by re-naming the Place du Collége de France the Place Marcelin Berthelot.

The death is announced of Mr. Joseph Kincaid, senior partner in the firm of Messrs. Kincaid, Waller, Manville, and Dawson, civil engineers. Mr. Kincaid, who was upwards of 70 years of age and a bachelor, had enjoyed excellent health until a few days before his death, when illness prevented him joining friends in the country. He was a Director of the Primitiva Gas and Electric Lighting Company of Buenos Ayres, Limited.

PUBLIC LIGHTING OF THE CITY OF LONDON.

Abolition of the Flat-Flame Gas-Burner.

THE report on the works executed by the Public Health Department of the Corporation of London during the year ending Dec. 31 last, prepared by the Engineer (Mr. Frank Sumner, M.Inst.C.E.), which has just been issued, contains particulars in regard to the public lighting. They open with the interesting statement that during the year "the system of lighting by means of incandescent gas-burners was completed, and the last public flat-flame lamp removed from the City streets." The number of gas-lamps (including experimental lamps) paid for by the Corporation at the end of the year was 2804—being a decrease of 35 during the twelve months, accounted for by the removal of a number of lamps in the side-streets adjacent to the thoroughfares lighted by high-pressure lamps, and also by lamps removed from certain courts. There were 2710 square and 90 circular lanterns and 2176 brackets in use; the hourly gas consumption of the ordinary burners ranging from 4·25 to 21·25 cubic feet, and of the high-pressure burners from 10 to 151 cubic feet. There were 66 back lamps and 26 special lamps in service last year. An additional 2000-candle power high-pressure lamp was put up in Lombard Street, at its junction with King William Street, in place of an electric arc lamp. The light from the new high-pressure gas-lamp at St. Martin's-le-Grand was found sufficient to permit of the electric arc lamp by the corner of this thoroughfare and Cheapside being removed; thereby effecting a saving of £26 per annum. The experimental lighting of certain main thoroughfares, authorized by the Court of Common Council on May 4, 1905, was continued during the year, and a small extension was carried out in Arthur Street East, Monument Square, and Lower Thames Street, opposite Billingsgate Market. The numbers of these experimental lamps are 35 low-pressure, consuming 7 cubic feet, 38 high-pressure burning 10 cubic feet, 46 burning 20 cubic feet, from one burning 30 cubic feet. The low-pressure lamps are in Fleet Street, and the 20-feet high-pressure lamps are in Queen Street and Queen Victoria Street.

In October last, a statement was laid before the Streets Committee relating to the annual maintenance of lighting the various areas; showing the difference in the cost of lighting the thoroughfares by incandescent gas compared with the method then in vogue—viz., electric arcs supplemented by incandescent gas. The statement, which was given in the "JOURNAL" for the 6th of November (p. 396), showed that the total estimated annual saving on the lighting bill as agreed by the Court of Common Council was £371, while the actual annual saving is £490—an increase of £119. This is accounted for mainly by the abolition of compressors (the lamps in Queen Victoria Street and Queen Street being connected direct to the Gas Company's high-pressure mains), the substitution of 600-candle power lamps on 11 rests for 900-candle lamps, and the rearrangement of the lamps and the extinguishing of 13 additional gas-lamps found to be unnecessary in the vicinity of the new lighting. The statement also gave the cost of carrying out the works; and it showed a reduction of £194 on the sum voted by the Court. This is accounted for by the saving in constructing and supplying a compressor-house and plant, and obviating the necessity for laying an independent high-pressure gas-main throughout the length of Queen Victoria Street. During the year five lamps of the new Scott-Snell type were fixed—one on the rest in Cheapside, and four in Cannon Street, Dowgate Hill, and Budge Row. In regard to them, Mr. Sumner says: "These lamps are of a self-intensifying character; and a lighting value of 600 candles is claimed for them, with a consumption of 15 cubic feet per hour, at an annual cost of £9 5s. per lamp per annum. The reliability of the automatic mechanism has not been sufficiently proved to warrant an extension of the use of this type of lamp at present."

The number of defective gas-lights observed and reported upon by the Inspector of Gas Lighting during the year was 1813; being 1654 ordinary and 159 high-pressure. The number observed by the police was 34 incandescent and 3 high-pressure lamps. The details of lighting defects in the ordinary incandescent lamps were: Feeble lights, 1298; lights went out, 52; not alight during night, 33—total, 1383. In addition, 271 defects in the lanterns and burners were reported to the Gas Company, and they were rectified. The readings of the meters attached to the public lamps in various parts of the City show that the full contract quantity of gas is given at these lamps; and Mr. Sumner is of opinion that the stipulated amount is furnished generally throughout the City, and that the regulators of the lamps are kept in proper condition. The public lamps were lighted whenever fog or unusual darkness occurred. This happened on eleven days during the past year, and entailed a cost of £180 1s. 6d.

On the subject of electric lighting, Mr. Sumner says the lighting of most of the main thoroughfares of the City by arc lamps was continued throughout the year. The number of lamps in operation at the close of the twelve months was 449; being a reduction of 16. The cost of each is £26 per annum. These lamps were lighted on five days when fog or unusual darkness occurred. The number of defective electric lamps observed during the year was 178; and the City of London Electric Light Company were fined for each failure. The Company withdrew their refusal to take down their arc lamps in Queen Victoria Street and Fleet Street, which had been lighted by incandescent gas-lamps, and the extinguishing of the arc lamps in their eastern district, which had been lighted by high-pressure gas, and proceeded with the extinguishing of the lights and the removal of the columns and brackets. In addition, five arc lamps were removed during the year in connection with a rearrangement of lighting. It was also decided to remove the arc lamp in Fore Street, near the entrance to Cripplegate Churchyard, and substitute gas-lamps for it.

THE LIGHTING AT THE DUBLIN EXHIBITION.

IN our Institution number, a special article appeared on "Impressions at the Dublin Exhibition." Since then, there have been occasional references in the "Electrical Times" to the subject of the lighting of the exhibition; and the latest one scoffed at some published expressions of opinion by a deputation from the Devonport Corporation Gas Department. Mr. P. S. Sheardown, who, be it known, is "Consulting Electrical Engineer (hon.), Irish International Exhibition," has addressed the following letter on the subject to our electrical contemporary:

> Perhaps it may interest you to learn that the arrangement made for lighting the exhibition was that half the supply was to be from electricity and half from the Dublin Gas Company, who were large guarantors, and offered special terms. When the lighting scheme was discussed, it was decided that most of the main buildings should be lit by electricity, which left the gas people with a big show outside; and they have made the most of their opportunity.
>
> I think it is not realized by some people that no matter what the source of the light, if there is only enough of it, the resultant illuminations or glare will be brilliant.
>
> The outside area lit by gas at the Dublin Exhibition is 51,100 square yards. This space is covered with 192 1500-candle power gas-lamps. The outside area lit by electricity is 68,155 square yards. This is done very satisfactorily with 90 2000-candle power flame arc lamps. This works out: One 1500-candle power gas-lamp per 266 square yards illuminated; one 2000-candle power arc lamp per 757 square yards illuminated. But in the main avenue the congestion of gas-lamps is still greater.
>
> The Art Gallery is lit throughout by electricity; but a few pilot gas-lamps are installed for use at night, in order to make it unnecessary for the night-watchmen to carry oil-lamps into the building. Where possible, it is, of course, always safer to have a second string to one's bow, even if the second string is a pound of candles. But I cannot understand the gas people trying to make capital out of the position of understudy.
>
> If the Devonport people had looked a little closer into things, they could have discovered a gas-lamp right over the electric generating plant in the Machinery Hall, which is most useful when the electric light fails, which it does regularly at eleven p.m. (shutting-down time) every evening.

We do not think that experienced electric lighting engineers will feel grateful to Mr. Sheardown for his letter. Mr. Sheardown is Electrical Engineer to the Tramways Company, and might with advantage have left the discussion of this subject to his brother electricians more experienced in this branch of the profession. Their silence is justified by the demonstration at the exhibition. It may be left to the general public to form their own opinion as to whether the area of the exhibition affording location to flame-arc lamps is, as stated by Mr. Sheardown, satisfactorily lighted; also as to whether those flame arc lamps can possibly be anything like 2000-candle power compared with the 1500-candle power high-pressure incandescent gas-lamps. In our article, "Impressions at the Exhibition," published on June 25, it was stated—

> Taking up a position in one part of the grounds, we see the end high-pressure gas-lamp in front of the Palace of Industries. There are three flame-arc lamps close by. The high-pressure gas-lamp illustrates what is meant by "light diffusion;" the flame arcs, what is meant by "light concentration."

Mr. Sheardown, we have no doubt, is a constant visitor at the Exhibition; but he does not seem to have taken the opportunity of comparing *one* high-pressure incandescent gas-lamp with *several* flame arcs. He is also apparently oblivious of the fact that the centre of the principal building has only eight high-pressure lamps, and is surrounded by flame arcs. There is no necessity to comment again in these columns on the contrast. Mr. Sheardown states that "If the Devonport people had looked a little closer into things, they would have discovered a gas-lamp right over the electric generating plant in the Machinery Hall, which is most useful when the electric light fails, which it does regularly at eleven p.m. (shutting-down time) every evening." This is quite correct. But it is rather more serious, and not quite so amusing, when one considers that the electric light has irregularly failed before the regulated shutting-down time mentioned by Mr. Sheardown, causing considerable consternation; also that a fire is reported to have been discovered in the Concert Hall—a wooden building—caused by a defective wire, which fire, had it not been found out immediately after it started, would probably have burnt to the ground the whole of the Main Entrance, the Concert Hall, and Restaurant. Of course, as Mr. Sheardown is Honorary Consulting Electrical Engineer, one would expect him to be aware of these matters.

When the lighting of the Exhibition was first discussed, the greatest opposition was offered to any gas lighting being introduced—it being argued that the Insurance Companies would not insure the buildings if gas were used, and that it would not be in the interests of the Exhibition to have gas lighting in any portion

of it. Mr. Sheardown now overlooks the fact that one-half of the Machinery Hall is lit by gas, practically the whole of the Main Entrance, and the Morehampton Road Entrance, the Gas Pavilion, and the centre of the principal building. He should also be aware that the Gas Company are not responsible for the number of lamps in the main avenue. Evidently the gentleman who was consulted by the Exhibition authorities thought it necessary to erect these lamps, in order to equalize the lighting of this portion of the grounds with that lit by flame-arc lamps. If he has seen the lighting, it is probable that in the next scheme he carries out, where the two systems are combined, he will reverse the order of things. Wisdom is born of experience.

DR. BUEB ON VERTICAL RETORTS AND OVEN CARBONIZING CHAMBERS.

THE following is an epitome of an article which Dr. J. Bueb, the deviser of the Dessau system of vertical retorts, has contributed to the "Journal für Gasbeleuchtung" on the relative merits of vertical retorts and large carbonizing chambers similar to those at the Munich Gas-Works, of which reports have been given in recent numbers of the "JOURNAL" (*ante*, pp. 438, 501).

Two methods are now being tried in place of the old system of gas manufacture, with a view to simplifying and cheapening the production of coal gas. One is the introduction of the coke-oven into gas-works, and the other the use of vertical retort-settings. In coke-works, the gas produced is chiefly used for heating the ovens, and any surplus is generally applied to heating boilers or supplying gas-engines. No considerable progress has been made in applying coke-oven gas in Europe in place of coal gas, for the following reasons: Ordinary coke-oven gas is not so uniform nor so good in quality as coal gas, because the mode of working differs, and the ovens are less sound than gas-retorts, while the reliability of lighting would be in question if the supply of gas to towns depended on the coke-works. Modern gas-works require relatively few workmen, and in the event of strikes they could, at a pinch, be run by the officials, with perhaps help from troops. Thus a town would not be left in darkness through a conspiracy of the workmen. But the coke-ovens are subsidiary to the mines and blast-furnaces, and could not guarantee to deliver gas in the event of either of these being shut down for any considerable period owing to a strike.

The coke-works, therefore, not being a trustworthy source of gas, it has been proposed to erect instead coke-ovens on the gas-works, and to distribute the gas produced over and above that required for heating the ovens. This surplus gas would amount from a good coking coal at the outside to 30 per cent. of the gas made; and as it would be taken from the early stages of carbonization, it would be equal in illuminating and heating power to the earlier coal gas. But whereas in ordinary gas-retort working there are, per ton of coal carbonized, about 0·55 ton of coke available for sale, and about 10,750 cubic feet of gas made, with coke-ovens the same quantity of available gas would be attended by the production of 2·33 tons of coke. A gas-works, therefore, which depended on the surplus gas from coke-ovens would put on the market more than four times its present output of coke, while even now the increasing make of coke can only be disposed of by considerable reductions in price.

The idea that the oven coke would be used for metallurgical purposes is only true to some extent, because to produce coke for such a use it would be necessary to carbonize only selected and washed coal, in order to keep the proportion of ash within the essential limits. Moreover, the existing coke-works would not be ousted by the gas-works without an industrial struggle. Thus it may be concluded generally that the possibility of making illuminating gas by means of coke-ovens depends entirely on the possibility of disposing of the immense quantity of coke produced; and this can only arise in exceptional cases. Having regard to the figures quoted above, and the position of the coke market at the present day, the conclusion must be drawn that, so far as European conditions are concerned, coal gas supply derived from the surplus gas from coke-ovens is industrially out of the question.

Attempts have, however, been made to introduce on gas-works coke-ovens heated by means of producer gas. Herr Rothenbach made trials of such ovens at Olten; but the time required for carbonization appears to have been too long, and consequently the cost of fuel for heating the ovens was too high. The German Continental Gas Company tried a system of coke-ovens, which may be described as horizontal chamber ovens, in which the separate chambers were divided into two overlying sections. The results were satisfactory, and the system was only abandoned because greater advantages were foreseen in the vertical retort system. Recently Herr Ries, of Munich, has tried a new modification of the coke-oven, differing from the earlier ones in that the chambers are no longer horizontal but inclined. The only advantage secured is that the coke slides out instead of having to be pressed out as in the ordinary coke-oven. But whereas coke-ovens are sometimes as long as 33 feet, such a length is out of the question with inclined chambers, because of the height and the consequent cost involved in the structure. The Munich chambers are limited to a length of 13 to 16½ feet, and are not adapted for receiving coal in some conditions.

The principles of carbonization are precisely the same in the Munich chambers as in the ordinary coke-oven. It is never possible to fill the chambers entirely with coal—for mechanical reasons, and because of the fritting of the slab of coke. Consequently there is always a highly superheated space in the upper part of the chamber, through which the gas must pass. The heavy hydrocarbons are there dissociated, and naphthalene is produced, according to the experience in coke-works, but not to so great an extent as in ordinary gas-retorts, because the free space is smaller and the velocity of the gas greater. The heat of the chambers must, however, be relatively high (Herr Ries says 1250° to 1300° C.) in order to obtain a good yield of gas; and this high temperature involves risk of decomposition of the gas.

In this respect and in the mode of heating, the chamber settings differ fundamentally from vertical retorts. In the latter, the superheating space is entirely avoided, and the retorts may be so charged that the fritting of the coal does not cause the coke to drop beneath the top of the heated zone. Consequently the gas passes away without suffering decomposition. Owing to its conical shape the vertical retort needs to be less highly heated above; but the chambers must be heated alike top and bottom in order to ensure uniform carbonization. Thus the course of carbonization follows different principles in the two systems. This is indicated by the higher yield of gas, the absence of naphthalene in the gas and tar, and the higher yield of ammonia, with the vertical retort.

It seems probable that in course of time the Munich coke-oven will secure to itself the advantages of the vertical retort system by the inclined oven being put into a vertical position. Experiments have been in progress at Dessau on the enlargement of the existing vertical retort; and if they prove successful, the large vertical retort will represent to a certain extent a vertically placed coke-oven. It has been said, in favour of the introduction of the coke-oven into the gas industry, that thereby night work would come to an end. It is instructive to consider what this really implies in practice.

Firstly, even with ordinary small retorts, the time required to work off a charge varies greatly with the kind of coal, and the difference would be intensified with the larger carbonizing chambers. Thus if the Munich chambers require twenty-four hours to work off Saar coal, they would take not less than thirty hours to carbonize Durham coal properly. But as soon as twelve or twenty-four hours is departed from, the charging of the retorts in the day-time only becomes out of the question.

Secondly, even if a gas-works always carbonizes the same coal in chambers of such a size that the charge is worked off in twenty-four hours, and if the charging is done wholly in the day-time, there would be a considerable difference between the lowest and the highest hour's make. The apparatus and connections would have to be adapted for the highest hour's make, and, consequently, considerably larger than under the present conditions of a tolerably uniform make throughout the day.

Thirdly, there is no appreciable economy as compared with vertical retort working consequent on the elimination of night-work, because a watchman is required; and it has been shown at the Oberspree (Berlin) Gas-Works that one stoker per shift suffices for the discharging and charging of vertical retorts.

Fourthly, the exclusion of night work would have the further disadvantage that there would be a considerable difference between the quality of the gas made in the day time and that made at night; and uniformity in the calorific power of the gas supplied is now essential. Consequently, costly mixing arrangements would be necessary—perhaps the holders would have to be doubled.

Fifthly, with the large inclined chambers with only day working, the quenching and conveying of all the coke at one time of the day would be troublesome, and would preclude the application of continuously running De Brouwer conveyors. Either costly quenching and conveying plant must be installed, or the coke must remain and be quenched in front of the settings, to the inconvenience of the operators on that side of the bench.

Sixthly, the chambers are not so well adapted as the vertical retort for the admission of steam with a view to increasing the make of gas, because the depth of the layer of coke is less, and uniform distribution of the steam through it is attended with great technical difficulties. Even if these difficulties were overcome, and water gas were made in the inclined chambers, it could only be produced shortly before the time for drawing the retorts; and if night work were excluded, this would mean still greater want of uniformity in the quality of the gas made, owing to the whole of the water gas being produced within the space of a few hours.

For the foregoing reasons, the author concludes that the practical elimination of night work by the adoption of coke-oven working presents great difficulty. Gas-works will, he thinks, decide upon which new system of setting to adopt (provided it is reliable in working) chiefly from the point of view of economy. The future will, he says, belong to the system in which, after taking account of the capital outlay, the cost of the gas made is, *cæteris paribus*, the lowest per 1000 cubic feet.

Professor H. Le Chatelier has been officially nominated Professor of Chemistry at the Paris Faculty of Sciences, in succession to the late Professor Henri Moissan.

OBITUARY.

Sir WILLIAM R. COPLAND, M.Inst.C.E., LL.D., died at his residence in Sandyford Place, Glasgow, on Monday last week. For some time he had been in failing health, but was able to be in London quite recently, giving evidence in support of the Renfrew County Council water scheme, of which he was the author. On his return to Glasgow he was confined to the house for about a fortnight, but immediate danger was not anticipated by his family or friends. He passed away suddenly, however, as the result of heart failure. Sir William was born in Stirling in 1838, and began business as a civil engineer in Glasgow in 1860. He rapidly acquired a very large practice in connection with water and sewage works, in respect of which he was very frequently consulted by authorities all over the United Kingdom. He received the honour of knighthood in June last year, in recognition chiefly of his services to the Glasgow and West of Scotland Technical College, of which he had been Chairman of the governing body since 1897.

Among the present generation of gas engineers, the name of HENRY FINLAY will not have been widely known; his part and lot in the official work of the industry having borne dates that have been deeply covered by time. Mr. Finlay was an octogenarian—in fact, he was in his 83rd year at the time of his death last Friday week. The latter three years, however, had been marred by illness which robbed him of active participation in the affairs of life. Just prior to then, he was frequently seen in the City attending those meetings that claimed his interest both in a directorial capacity and as a shareholder. Mr. Finlay was trained as a mechanical engineer at an East London millwright's. His early days in the gas industry were passed under that moulder of excellent business men, Mr. Robert Jones, of the Commercial Gas Company, and father of Mr. H. E. Jones. He was Chief Assistant (followed by the late Mr. Frank Morris) to Mr. Robert Jones, who acted as Arbitrator between Mr. Alex. A. Croll and the Surrey Consumers' Gas Company on the termination of Mr. Croll's lease. Subsequently, as Consulting Engineer to the Surrey Company, Mr. Jones recommended Mr. Finlay as Engineer to the Company. In that service he remained until the amalgamation of the Surrey Company with the South Metropolitan Company, of which Mr. Finlay became a Director, but retired after a few years, on the amalgamation with the Phœnix Gas Company. During his service with the Surrey Consumers' Company, several handsome and valuable presentations of silver were made to him, in recognition of his work; and these gifts have ever since been the admiration of his friends. Among his other occupations of later years, Mr. Finlay was a Director for a lengthened period of the Gas-Meter Company, and was for some three years Chairman. He was also a Director of the old Bahia Company, and was one of its Liquidators upon the Municipality taking over the property. Among the other interests in the administration of which he was engaged was the Hope Lighterage Company, of which he was Chairman. Mr. Finlay was very successful in his gas administration; and he enjoyed a further success in financial matters outside gas investments. It is believed he died a fairly rich man. Mr. Finlay, who was a bachelor, had a brother in the service of the Imperial Gas Company, who predeceased him. Throughout his long life, Mr. Finlay was much attached to his old chief, the late Mr. Robert Jones, and never tired of expressing his regard for, and admiration of, him. In this particular, he was emulated by his successor, Mr. Frank Morris. It is a strange coincidence that Mr. Finlay and Mr. Morris should have started in the same office, and died within a few weeks of each other. At the City of London Cemetery, Ilford, the last scene in the long chapter was closed on Thursday.

Wales and Monmouthshire District Institution of Gas Engineers and Managers.—The next general meeting of this Institution will be held in the Gas Offices, Shrewsbury, on Wednesday, the 4th prox. According to the programme issued by the Hon. Secretary (Mr. Octavius Thomas, of Pentre), Mr. Robert A. Browning, Assoc.M.Inst.C.E., the retiring President, will occupy the chair during the transaction of the opening business, and will then introduce his successor, Mr. Edward Jones, M.I.Mech.E., of Burslem (formerly of Pontypridd), who will deliver his Inaugural Address. There will be one paper—"Some Notes on the New Electric Lamps," by Mr. J. H. Canning, of Newport. At the close of the meeting, the members will visit the Shrewsbury Gas-Works; and they will subsequently be invited to tea by Mr. W. Belton, the Engineer and Secretary of the Gas Company.

Manchester District Institution of Gas Engineers.—As already announced in the "JOURNAL," the excursion meeting of the Institution will be held next Saturday, at Worksop and the Dukeries. We learn from the programme issued by the Hon. Secretary (Mr. H. Kendrick, of Stretford) that it will be necessary to make an early start from Manchester, in order to reach Welbeck Abbey—the chief place of interest in the district—in time to obtain admission. Coaches will meet the train at Worksop, and the party will be conveyed to the Royal Hotel, where light refreshments will be served. They will then drive to the Abbey, and afterwards to Edwinstowe for "Major Oak," stopping for luncheon at the Hop-Pole Hotel, Ollerton. After lunch the drive will be continued back to Worksop, *viâ* Clumber and Thoresby, and tea will be provided at the Royal Hotel in the former town.

CAPITAL INVESTED IN THE GAS INDUSTRY.

By NORTON H. HUMPHRYS, Assoc.M.Inst.C.E., F.C.S.

I have been interested in the remarks made by the President of the Institution of Gas Engineers on the respective capital indebtedness of companies and local authorities, which he sums up as follows: "It must be apparent to all that, in their treatment of capital charges, the local authorities have been wise in their generation, and that their position in years to come is likely to be a much stronger one than that of companies."

These words express emphatic approval of the policy of gradually paying off capital, as usual with local authorities, rather than allowing all capital outlay to stand as a permanent debt, as is the law in respect to gas companies. I do not understand that this matter, however, is in any sense evidence of superior business acumen on the part of local authorities. It is rather a legal accident. No doubt there are numerous boards of directors who would have been thankful, in prosperous years, to apply some of the surplus to the permanent improvement of the prospects of the undertaking, by reduction of the capital debt, but if they did so would be called to account for contravention of their Act of Parliament; and possibly there are gas committees who at times have found it a hardship to provide for the sinking fund as well as for interest on loans, and would be glad to miss a year or else to extend the time of repayment. In either case it is a matter of Hobson's choice; and the position of the companies is in no sense a reproach to them. At one time there may have been an inducement to unduly swell the capital account. But that disappeared with the introduction of the auction clauses; and I venture to think that at present the majority of gas company directors fully appreciate the importance of keeping a rigid hand on the capital account. A comparison of the accounts just published with those of thirty years ago will show that, in a general way, a much wider construction is now placed upon the words "repairs and renewals" than was formerly the rule.

As far back as 1882, I had the privilege of opening a discussion at the Torquay meeting of the South-West Association of Gas Managers on the subject of a sinking fund or of redeemable capital for gas companies; and subsequent events have proved the correctness of many of the remarks made on that occasion. The views then expressed attracted very little attention at the time. There was no discussion of the subject worthy the name, and it has scarcely been mentioned since. But having in 1882 claimed that "it is very desirable that gas undertakings . . . should have power to form sinking funds," it is gratifying to meet with such an authoritive approval of the policy. No one will dispute the fact that local authorities have largely reduced their capital liabilities. But who found the money? There is only one answer to this question; and that is the gas consumer. A person or company supplied with gas by a statutory gas company pays the company's working expenses *plus* the average interest and dividend on capital invested, and no more; but if supplied by a corporation running a thirty years' purchase, he also pays something extra, according to the position of the loan.

TABLE I.

1.	1882	..	£600	..	£540	..	£1,140
2.	1883	..	,,	..	522	..	1,122
3.	1884	..	,,	..	504	..	1,104
4.	1885	..	,,	..	486	..	1,086
5.	1886	..	,,	..	468	..	1,068
6.	1887	..	,,	..	450	..	1,050
7.	1888	..	,,	..	432	..	1,032
8.	1889	..	,,	..	414	..	1,014
9.	1890	..	,,	..	396	..	996
10.	1891	..	,,	..	378	..	978
11.	1892	..	,,	..	360	..	960
12.	1893	..	,,	..	342	..	942
13.	1894	..	,,	..	324	..	924
14.	1895	..	,,	..	306	..	906
15.	1896	..	,,	..	288	..	888
16.	1897	..	,,	..	270	..	870
17.	1898	..	,,	..	252	..	852
18.	1899	..	,,	..	234	..	834
19.	1900	..	,,	..	216	..	816
20.	1901	..	,,	..	198	..	798
21.	1902	..	,,	..	180	..	780
22.	1903	..	,,	..	162	..	762
23.	1904	..	,,	..	144	..	744
24.	1905	..	,,	..	126	..	726
25.	1906	..	,,	..	108	..	708
26.	1907	..	,,	..	90	..	690
27.	1908	..	,,	..	72	..	672
28.	1909	..	,,	..	54	..	654
29.	1910	..	,,	..	36	..	636
30.	1911	..	,,	..	18	..	618
			£18,000	..	£8,370	..	£26,370

To make this point plain, I may again quote from the paper above instanced. A capital outlay of £10,000 is compared (*a*) with a fixed dividend, and (*b*) with a thirty years' purchase scheme. The average rate of interest paid by the company may now be taken at 6 per cent.; and interest at this rate would, in thirty years, amount to £18,000. It is assumed that a local authority buying up this amount of capital will have to pay £18,000 for it, and would raise a loan for this amount—say, at 3 per cent. interest—payable in thirty years by equal annual

instalments. The consumers have to meet a fixed instalment of £600 a year during the thirty years, and also to pay a gradually decreasing interest. The charge, instead of being constant, will vary in each year, as shown in Table I., which illustrates a purchase supposed to have been effected in 1882. These two examples of finance are so diverse that it is impossible to make anything like a comparison on all-fours between them. Instead of paying his *quota* of £600 per annum to the company, he would pay a sum ranging from £1140 in the first year, by equal reductions of £18, down to £618 in the thirtieth year. In all he would pay during the thirty years £8370 more to the corporation than to the company. But with the thirty-first year (in this case, 1912) a new era dawns for the corporation. They now have nothing to pay; whereas the company's interest is undiminished.

It is obvious that any comparisons between the fixed capital of a gas company and the gradually disappearing balance of a local authority are fallacious, unless the total quantity raised by the corporation, and the proportion paid off, are stated. In the example before us, where is the utility of stating that in 1882 the capital of the company was the same as that of the corporation, that in 1897 it was double, and that in 1912 the corporation had no capital debt at all. It is only the natural sequence of the respective financial policies, which are beyond the control of the managing authorities in each case.

Table I. is merely a fictitious example assumed for the purpose of illustrating the fact that the consumer under a local authority will pay more for his gas than he would do if he was supplied by a statutory company during the period of repayment of capital. Whether he would obtain a compensating advantage at the conclusion of that term is a point which it is not proposed to discuss. That such a period has not yet arrived is evident from Table II., which deals with totals for the year ended Dec. 31, 1905, as given in the Parliamentary Returns. The balance available for profit on the year's working was 23·9 per cent. of the income in the case of the companies, and 26·5 per cent. by the local authorities. It is evident that, in the latter case, the consumers paid £250,000 more than they would have paid if supplied by companies, and that the consumers lose this amount through being under corporation management. If the whole belonged to local authorities, they would pay £700,000 more.

But the corporations score a point, apparently, when these factors are divided by the quantity of gas sold. It will be observed that this factor does not in any sense represent the average selling price of gas, which is really something considerably less, because the gross income includes receipts for rents and residuals. But it would appear from such a comparison that the authorities sell gas at 4d. per 1000 cubic feet less, and that the profit is the same. It might be claimed that this is a proof in favour of corporation management. It does not prove anything of the sort. We have seen that the capital of the two classes of undertakings is on totally diverse footings; and the same holds good in reference to the selling price of gas.

TABLE II.—*Receipts, Expenditure and Profit for the Year ended Dec. 31, 1905.*

	Companies.		Local Authorities.
Gross receipts	£17,617,598	..	£9,636,107
,, expenditure	13,410,307	..	7,085,710
Balance, being profit	£4,207,291	..	£2,550,397
Profit per cent.	23·9	..	26·5
Per 1000 cubic feet of gas sold—			
	s. d.		s. d.
Receipts	3 6	..	3 2
Expenditure	2 8	..	2 4
Profit	0 10	..	0 10

It has already been observed that the companies include a number of small concerns. The chief question with the would-be purchaser of the gas undertaking is how to conceal the facts above noticed from the consumer, who may possibly prefer gas at the lowest practicable selling price, to paying an additional loading for the benefit of posterity. He must therefore be conciliated by keeping clear of a rise of price, or perhaps receive a sop in the shape of a small reduction, and at the same time the sinking fund must be met. The most promising quarry is a concern that has followed Mr. Hunt's advice and kept the capital down, or where, for other reasons, the consumers have been accustomed to pay a fairly liberal figure, according to actual cost and local circumstances, for their gas. The current price will be taken as a standard of comparison. Or if the district admits of considerable expansion of business, the prospective profits can be counted on, and the increase that under a company would have to go to a reduction in the price of gas can be diverted into the sinking fund, and no one know anything about it. Improvements resulting in a reduction of working costs may be applied in the same way.

It follows as a natural consequence that only the best of the gas undertakings find their way into the corporation preserves. The small struggling concern in a decaying district, saddled with dear coal and iron and with other disadvantages, is not so likely to be bought up as the flourishing undertaking in the coal and iron district, combining all the advantages of cheap material, and a large consumption per mile of main and per head of population. The question of average size no doubt enters into the comparison; but the most important is the geographical one. This point is elucidated in Table III., which is simply copied from the parliamentary returns, and shows the number of undertakings in each county; and it clearly shows the preference evinced. Let us appreciate the following facts.

1.—Out of the 270 undertakings, nearly one-half are comprised in the four counties of Yorkshire, Lancashire, Staffordshire, and Cheshire. In these four counties there are 107 local authority and 113 company undertakings.

2.—That in some twenty counties there are no corporation undertakings at all. Amongst these are: Hampshire (16 companies), Middlesex (21), Surrey (20), and Sussex (18). There are also several counties where the companies are in a large majority—Essex, Hertford, Kent, Northampton, Somerset, and Wiltshire.

TABLE III.

	Companies.		Local Authorities.
Bedfordshire	6	..	—
Berkshire	5	..	4
Brecknockshire	2	..	—
Buckinghamshire	5	..	—
Cambridgeshire	4	..	—
Cardiganshire	2	..	—
Carmarthenshire	2	..	—
Carnarvonshire	4	..	6
Cheshire	13	..	11
Cornwall	2	..	1
Cumberland	1	..	7
Denbighshire	3	..	1
Derbyshire	17	..	6
Devonshire	12	..	6
Dorsetshire	4	..	1
Durham	12	..	3
Essex	19	..	4
Flintshire	6	..	1
Glamorganshire	10	..	8
Gloucestershire	7	..	—
Hampshire	16	..	—
Herefordshire	3	..	1
Hertfordshire	13	..	1
Huntingdon	3	..	—
Isle of Wight	8	..	1
Kent	25	..	4
Lancashire	28	..	42
Leicestershire	5	..	7
Lincolnshire	11	..	5
London	5	..	—
Merionethshire	1	..	—
Monmouth	—	..	4
Middlesex	21	..	—
Montgomery	—	..	1
Norfolk	6	..	3
Northampton	7	..	1
Northumberland	7	..	—
Nottinghamshire	3	..	5
Oxfordshire	4	..	—
Pembrokeshire	3	..	2
Rutland	1	..	—
Shropshire	5	..	3
Somerset	12	..	3
Staffordshire	15	..	14
Suffolk	8	..	1
Surrey	20	..	—
Sussex	18	..	—
Warwickshire	7	..	3
Westmoreland	1	..	3
Wiltshire	10	..	2
Worcestershire	6	..	5
Yorkshire	57	..	40
Aberdeenshire	—	..	2
Argyleyshire	—	..	1
Ayrshire	—	..	4
Banffshire	—	..	1
Buteshire	—	..	1
Clackmannanshire	—	..	2
Dumbartonshire	—	..	3
Dumfriesshire	—	..	2
Edinburgh	1	..	—
Elgin	—	..	1
Fifeshire	—	..	3
Forfarshire	—	..	4
Haddingtonshire	—	..	2
Invernessshire	—	..	1
Kircudbbright	—	..	1
Lanarkshire	2	..	4
Midlothian	—	..	1
Peebles	—	..	1
Perthshire	1	..	1
Renfrewshire	—	..	6
Ross	—	..	2
Stirling	1	..	3
Antrim	—	..	2
Clare	—	..	1
Cork	2	..	—
Down	1	..	3
Dublin	1	..	—
Fermanagh	1	..	—
Kerry	—	..	1
Limerick	—	..	1
Londonderry	1	..	1
Louth	1	..	1
Sligo	1	..	—
Tipperary	—	..	1
Tyrone	—	..	2
Waterford	1	..	—
Wexford	1	..	—

What are the conditions with regard to the price of coal and iron, the consumption per mile and per consumer, the prospects of large consumption for technical purposes, and other causes that influence both capital and selling prices in regard to the four counties in Class I., as compared with the ten counties named in Class II.? It is not necessary to labour such an obvious point. No fair comparison can be made between such varying circumstances. Where is the fairness of comparing the capital and selling price in Yorkshire with that in Sussex, or Lancashire with Kent. If a comparison is wanted, it should be not only between undertakings of the same size, but of the same district. Under present circumstances, the predominance of the local authorities in the fat counties and their absence in the lean ones renders anything like a fair comparison impossible. In a fat county the price of coal may not exceed three times the selling price of gas; in a lean county, coal may cost six times as much. The same holds good with iron, though in a lesser degree.

What will be the practical effect on the position of gas companies when the local authorities have all attained to that possession of a financial Nirvana promised as the reward for buying up the gas undertaking? Will they reduce their prices to an extent sufficient to place the neighbouring gas companies in an invidious position, or lead to the confiscation of such undertakings as a necessary sacrifice to the public welfare? Time alone will show. Sufficient for the day is the evil thereof.

Referring to companies only, there are several ways by which the capital liability can be reduced, or, in other words, the proportion between capital and revenue. The secret of good financial management consists largely in a correct and fair adjustment of these two accounts. The output can be increased by adopting improved processes, such as those which increase the make per mouthpiece or per ton of coal. Obsolete and unused or worn-out plant can be replaced at the expense of the revenue account. But apart from this, there is a quantity of outlay, such as that for meters or appliances on hire, which cannot fairly be called permanent capital. A meter or stove costing £2 is not worth £2, or anything like it, after three months' use. At best, it would not realize 50 per cent. of its cost in the open market. Why, then, should the concern be saddled with a permanent debt of £2 for it? I still hold that gas companies might with advantage adopt

some plan for redeeming a portion of their permanent capital, and that what we might call incidental income, such as a part of the excess profits during an exceptionally favourable year, the interest on reserve investments, or the premiums received on capital issued by auction, might well be applied for this purpose. The concern would be benefited more than if the balance lay idle in Government securities at 2½ per cent.

COLOUR VALUES OF ARTIFICIAL LIGHTS.

THE recently published transactions of the Illuminating Engineering Society for the month of May include a report of a lecture on "Colour Values of Artificial Illuminants," delivered by Mr. G. H. Stickney before the New York Section of the Society. The lecturer presented some experiments bearing upon the neutralization and interference of light rays; and he also dealt with the colour difficulties encountered in matching goods under various illuminants.

Mr. Stickney pointed out the difference in composition—that is, in the proportion of different colours—which exists between artificial lights and daylight. In all cases where the so-called "daylight balance" of colours is not maintained, the light ceases to be white; the excess or absence of some particular colour being noticeable in the colour effect and the general lack of clearness. Instances of the effect of colour are given. For example, it is known that the mercury arc does not contain any appreciable amount of red; and a piece of material which would reflect red rays under a white light would appear black by total absorption under this light. Yellow materials displayed in the light of the Nernst or incandescent lamps become pronounced, and slight differences in pale yellow are hardly distinguishable from white. The same relation exists between green and white exhibited under the Welsbach gas or vapour hydrocarbon lights.

Direct and alternating current enclosed arcs emit an excessive amount of violet light when equipped with clear globes, so that blue and violet materials under this light are stronger in tone than in daylight. The excess violet light can be corrected by opal enclosing globes and other means.

Mr. Stickney referred to three instruments used in contrasting lights for colour matching and selection—viz., the lumichromoscope, the photochromoscope, and the parachromoscope; and he stated that with any of these instruments the effects of various lights on coloured fabrics can be compared. The first-named instrument is described as the most practical for general demonstration purposes. The apparatus is arranged so that four lights —say, the arc, Welsbach, Nernst, and glow lamps—fall simultaneously on the material to be examined. Each light forms a patch 2½ inches square with a black border separating each square so as to reduce simultaneous contrast or gradation. The lamps are placed at such a distance that the relative intensity of the different lights falling on the material is the same; thus eliminating tint and shade effects which take place when the intensities are of unequal strength.

The lecturer then gave the following table showing the effect of coloured lights on aniline-dyed materials. The observations are from tests made by M. Chevreul at the Gobelins Tapestry Works in Paris, with some additions by Mr. W. D'A. Ryan.

Colour.	Appearance Under Orange Rays.	Appearance Under Red Rays.
White	Orange	Red
Red	Reddish orange	Deeper red
Orange	Deeper orange	Orange red
Yellow	Orange yellow	Orange
Green	Dark yellow green	Yellowish grey
Blue	Dark reddish grey	Violet
Violet	Dark purplish grey	Purple
Black	Brownish black	Rusty black

Colour.	Appearance Under Yellow Rays.	Appearance Under Green Rays.
White	Yellow	Green
Red	Orange brown	Yellowish brown
Orange	Orange yellow	Greyish leaf green
Yellow	Deeper yellow	Yellowish green
Green	Yellowish green	Deeper green
Blue	Slaty grey	Bluish green
Violet	Purplish grey	Bluish grey
Black	Olive black	Dark greenish grey

Colour.	Appearance Under Blue Rays.	Appearance Under Violet Rays.
White	Blue	Violet
Red	Purple	Purple
Orange	Plum brown	Reddish grey
Yellow	Yellowish grey	Purplish grey
Green	Bluish green	Bluish grey
Blue	Deeper blue	Bluish violet
Violet	Deep bluish Violet	Deeper violet
Black	Bluish black	Violet black

The lecturer remarked that the arc lamp is the most efficient source of artificial illumination; but as high efficiency generally goes hand in hand with high intrinsic brilliancy, he did not regard the arc in its distribution as by any means the ideal for general interior illumination—the objection being partly met by the use of low-power lamps. Mr. Stickney considered the enclosed arc lamp as best for interior mercantile lighting where colour values are of importance, but preferred a yellow-tinted light for places such as restaurants, residences, and the like.

A further table was furnished showing the predominating colour of artificial lights—

Lamp.	Colour.
Enclosed arc—clear globes	Bluish white
,, ,, opal globe and selective diffuser	White
Nernst lamp—new glower	Pale lemon yellow
,, ,, seasoned glower	Deep ,, ,,
Incandescent glow—new	Yellow
,, ,, seasoned	Pale orange yellow
Welsbach and vapour hydrocarbon—new	Greenish white
,, ,, ,, seasoned	,, yellow
Ordinary gas flame	Reddish yellow
Mercury arc lamp	Blue green

In the discussion which followed the lecture, Mr. D. M'Farlan Moore advocated as a standard the use of the vacuum tube filled with carbon dioxide at a definite pressure and intensity; this furnishing a light more closely approximating daylight than any other light produced. He said dye-works experts had not been able to detect any difference between the most delicate lavender shades when matching at night under this tube and in the daytime by daylight. Such a standard could be used for the comparison of coloured lights. For instance, if it were claimed that a certain light had a pink colour, it could be expressed as pink compared with the carbon dioxide light. Mr. Moore went on to remark that the efficiency of any light source is largely dependent upon its colour; but a subsequent speaker—Mr. G. L. Hunter—rightly added that the efficiency varies also with the colour of the walls, and that in practical illumination they cannot be dissociated. Mr. Moore emphasized the fact that yellow rays have a maximum effect upon the eyes; and he drew attention to the efficiency value of a light which predominates in yellow or green as compared with a larger number of prominent colours.

A later speaker—Dr. H. H. Seabrook—dealt with the question from a physiological point of view, and referred to the effect of coloured rays upon the eye. He pointed out that the anterior structures of the eyes are inflamed and the human lens is injured by ultra-violet rays. The lens absorbs the rays to a variable extent; thus protecting more or less the posterior structures. It has been shown, as might be expected, that the blue and violet spectral lights cause damage less in degree to ultra-violet rays. Dr. Van Generen Short found in 1887 that the chemical rays of light which are not absorbed by the lens of the eye produce dissimilation of the retinal pigment. He noted further that the disassimilation and cell wandering is at a minimum in yellow light, which is, of course, the light which contains the luminous rays in the greatest quantity.

Mr. T. A. Litle, jun., pointed out that the best mantles had not been employed in obtaining the results given by the lecturer; those used giving a greenish white light. He said that, in order to give the Welsbach mantle a mellower light, the cerium content had been increased, with the result that there were more red rays, with neutralization of some of the green rays.

Turning to the report, in the same issue of the "Transactions," of a topical discussion on photometrical instruments which took place before the New England Section of the Society, we find that the question of the effect of colour in artificial lights again cropped up. Professor G. C. Shaad gave a short account of tests made of illumination obtained from mercury vapour and carbon incandescent lamps; the two systems being combined in the hope that the red rays from the latter would correct the distinctly green light of the former, and produce a result approximating to daylight. A curious increase in the total illumination resulted from the combination as compared with the sum of the illumination obtained from each system tested separately. The room in which the tests were conducted measured 44 ft. by 25 ft. 6 in. and 12 feet high, and was finished in a light yellow tint. The Weber photometer used for testing is stated as giving excellent results with the incandescent lamps, and also with the combination. When used with the mercury vapour lamps alone, however, difficulty was experienced in getting balances due to differences in colour of the standard and of the lamps tested, though two experimentalists differed only to the extent of 5 per cent. in their readings. The interesting feature of the tests is found in the fact that while the average illumination obtained with the carbon incandescent lamps alone was 1·1 candle-feet, and that of the mercury vapour lamps 2·5 candle-feet, the average illumination obtained with both systems in use together amounted to 4·5 candle-feet, which is much greater than that given by adding the two averages obtained separately (3·6).

Professor Shaad suggested three possible explanations. The first was error in the calibration of the instrument. But this had been checked and found to be correct. The second referred to the discrepancy due to the use of a photometer of this type in comparison of lights differing in colour. This seems reasonable, but does not account, according to the Professor, for so large a discrepancy. The remaining explanation is that the combination of the red rays which are prominent in the incandescent lamp with the green of the mercury lamp gives a condition which, measured by the eye, afforded better illumination; in other words, the combination gives a colour of light by which things can be perceived with greater distinctness—the light appearing to be of higher intensity than with either light alone. The Professor's own opinion, expressed at the conclusion of the contribution, was that the discrepancy found was largely owing to the attempt to measure illumination, due to such colour sources, with the Weber photometer.

METROPOLITAN WATER BOARD.

Fourth Annual Report.

We have received from the Clerk of the Metropolitan Water Board (Mr. A. B. Pilling) a copy of the fourth annual report, covering the twelve months ending the 31st of March last, which has lately been issued. It furnishes a large amount of statistical and other information in regard to the supply of water in the Board's area, which extends to upwards of 537 square miles, and comprises six Administrative Counties—viz., the whole of London and parts of Essex, Hertford, Kent, Middlesex, and Surrey.

The first section of the report deals with the constitution of the Board, the Chairman of which, as our readers are aware, is Sir Melvill Beachcroft. The administrative work is entrusted to six Committees—Appeal and Assessment, Finance, General Purposes, Law and Parliamentary, Water Examination, and Works and Stores. In the second annual report, reference was made to the steps taken to consolidate the undertakings under one administration, and their organization into five main branches under the Board's principal officers—the Clerk, Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.), Comptroller (Mr. F. E. Harris), Solicitor (Mr. W. Moon), and Director of Water Examinations (Dr. A. C. Houston). This organization was maintained during the year under review. Acting under the provisions of section 47 of the Metropolis Water Act, 1902, the Board granted in 66 cases superannuation allowances to officers and servants transferred from the Water Companies; bringing up the number to 155 since the "appointed day." There were 39 offices abolished in the year; making a total of 77 since the Board took possession. At the end of June, there were 122 chief officers and assistants in the service of the Board; and the entire staff consisted of 770, whose total salaries amounted to £154,861, or at the rate of £201 2s. per head.

The second section of the report deals with financial matters. In the two preceding reports, an account was given of the arbitration proceedings in relation to the transfer of the water undertakings and matter arising out of them. As these were finally closed during the year ending in March, the salient features are recapitulated. The claims of the Companies amounted to £50,939,198, and they were settled for £30,662,323. The acquisition of the undertakings of the Urban District Councils of Tottenham and Enfield cost £151,980 (Tottenham £79,150 and Enfield £72,829 14s. 4d.); while the sale of portions of the undertakings in Croydon and Richmond yielded £260,810 (Croydon £225,810 and Richmond £35,000). The compensation awards to the Companies were discharged by the issue of £32,818,609 of the Board's "B" stock (equivalent to £29,971,332 in cash), and by the payment of a cash balance of £690,991. In addition, a total claim was made for £316,726, Directors' compensation for loss of office; and it was settled for £219,287. The expenses of the Court of Arbitration amounted to £21,016, after deducting £4221 generously returned to the Board by Sir Edward Fry and Sir Hugh Owen. The net cost of the acquisition of the several undertakings may be stated to be £31,149,005 cash, exclusive of the debenture stocks and mortgage loans tranferred from the Companies to the Board, which amounted in all to £11,624,948. The capital debt of the Board is divided as follows: "A" stock, £6,060,165; "B" stock, £34,110,226; redeemable debenture stocks, mortgages, &c., £7,236,638—total, £47,407,029. The annual charge for interest is £1,426,431, or equivalent to 4·2d. per 1000 gallons of water supplied.

In the third section, the subject of the Board's assessments is dealt with. As showing the large amount of detail work carried out in the Supervisor's branch of the Clerk's department under the direction of the Appeal and Assessment Committee, it may be mentioned that no less than 48,956 communications were registered as having been received during the twelve months covered by the report, and 16,936 letters and memoranda despatched from this section alone. This volume of correspondence resulted in 5517 building supplies arranged for, 2476 meter transactions completed, 120 new fire supplies laid on, 65 special agreements executed for supplies in respect of non-rated premises, and 360 pipe guarantees obtained in respect of extensions of mains. Moreover, in consequence of the quinquennial revision of the valuation lists throughout the Administrative County of London, the water charges of no less than 246,465 premises out of a total of 638,881 had to be revised. In 173,532 cases, the charges were increased in the aggregate by £71,773, and in 72,933 cases they were reduced in the aggregate by £16,456; the result being an increase of gross revenue of upwards of £55,000, or nearly £25,000 in excess of the previous revision.

Perhaps the most interesting section of the report, from our readers' point of view, is the fourth, which furnishes particulars relating to the supply of water. The Board's sources of supply are four in number: (1) the Rivers Thames and Lea; (2) gravel beds adjoining the main stream of the Thames and other gravel beds at Hanworth; (3) natural springs; and (4) wells sunk in the chalk or other strata in the Lea Valley on the north of the Thames, in Kent, and at certain other points to the south of the Thames. The Thames furnished 57·263 per cent. of the Board's supply, compared with 56·432 per cent. in the year 1905-6. The total quantity of water supplied was upwards of 82,125·2 million gallons; the average daily supply being 225 million gallons. Of this, the southern district took the largest proportion—28·313 per cent.; the Kent district the smallest—9·009 per cent. The East London district was dependent for its supply upon the Rivers Thames and Lea, eleven wells in the Lea Valley, and the gravel beds at Hanworth. It obtained 57·002 per cent. of its supply from the Lea, 20·029 per cent. from the Thames, 21·628 per cent. from wells, and 1·341 per cent. from the gravel beds. The district consumed 18·690 per cent. of the total supply in the Board's area, compared with 19·516 per cent. in 1905-6. The New River district derived its supply from the Lea, the Chadwell spring, eighteen wells in the Lea Valley (most of which feed the New River channel), and from the Thames. The latter supply is obtained indirectly from the Staines reservoirs through the Grand Junction and West Middlesex systems pending the completion of the Staines communication works, and from the Southwark and Vauxhall division by way of the intercommunication works at Battersea. A small supply for non-domestic use is also obtained from the Hampstead and Highgate ponds. Of the total supply to the district, 46·418 per cent. was obtained from the Lea, 6·185 per cent. from the Thames, 47·195 per cent. from wells and springs, and 0·202 per cent. from the ponds.

The southern district (comprising the Lambeth and Southwark and Vauxhall divisions) derived its main supply from the Thames, with a supplementary source from wells at Selhurst (Lambeth) and at Streatham, Honor Oak, and Merton Abbey (Southwark and Vauxhall). The total supply of the district from the Thames was 97·686 per cent., and from the wells 2·314 per cent. The Lambeth division obtained 96·054 per cent. of its supply from the Thames, and 3·946 per cent. from the wells; the Southwark and Vauxhall division, 99·401 per cent. from the Thames, and 0·599 per cent. from the wells. The Merton Abbey Well was brought into use for the first time in July, 1906, and was pumped during that and the three succeeding months. The western district (which comprises the areas of the Chelsea, Grand Junction, and West Middlesex Water Companies) is supplied wholly from the Thames. In the year under review, Chelsea took 22·686 per cent., Grand Junction 32·287 per cent., and West Middlesex 45·027 per cent. of the total supply to the district.

There was a general increase in the supply from the Thames to every district, from a total of 44,904 million gallons in 1905-6 to 47,028 million gallons in 1906-7—equal to a percentage increase of 4·729. The New River district increased its supply from the Thames by nearly 60 per cent. The southern district took 48·3 per cent., and the western district 43 per cent. of the total supply derived from the Thames. The eastern district took 0·974 per cent. less from the Lea and 3·659 per cent. less from the wells. The New River decreased its supply from the Lea 0·102 per cent., but increased it from the wells by 6·145 per cent. The New River had the larger percentage of the Lea Valley well water—69·285, against 30·715 received by the eastern district. As regards the Lea river water, the eastern district took 54·295 per cent., and the New River district 45·705 per cent. of the total supply.

Tables contained in the numerous appendices to the report show that the total supply derived by the Board from the wells in the year 1906-7 amounted to 18,744·9 million gallons in total volume, or to 51·4 million gallons average daily supply, of which volume the wells north of the Thames yielded 57·660 per cent., and those south of the Thames 42·340 per cent. There are no wells in the western district. The Kent district, which is wholly supplied with well water, received 39·470 per cent. of the total supply from this source, which is the purest of those at the command of the Board. In the latter district there was a total increase of 518·9 million gallons supplied as compared with the previous year, representing an increase of 7·543 per cent. In the southern district, there was a percentage decrease of 11·519 from this source.

Other tables give particulars of the supply in the months of maximum and minimum average daily supply during the year. The average per head ranged from 45·43 gallons in the Chelsea division to 30·19 gallons in the eastern district during the maximum month; the general average being 36·74 gallons as compared with 37·58 and 39·73 gallons in the two preceding years. There was over the whole of the Board's area a continued reduction in the supply furnished during the maximum month—viz., 0·714 per cent., compared with 2·144 per cent. in 1905-6. With regard to the month of minimum average daily supply, the rate per head per day ranged from 37·22 gallons in the Chelsea Division to 24·83 gallons in the eastern district; the general average during the minimum month having been 30·13 gallons, compared with 29·63 and 30·62 gallons in the two preceding years.

The total estimated population supplied by the Board at the close of the year was 6,893,780, representing no less than 15·8 per cent. of the population of Great Britain and Ireland. The average estimated population supplied during the year was 6,851,045. Of these, 3,611,118, or 52·709 per cent., had Thames water; 1,518,195, or 22·160 per cent., Lea water; and 1,721,732, or 25·131 per cent., water derived from springs and wells. The average daily supply per head per day over the whole area was 32·84 gallons, against 32·31 gallons and 33·54 gallons in the two immediately preceding years. The average daily supply per service was 213·46 gallons, compared with 210·52 gallons and 219·80 gallons; and the average population supplied per service was 6·5, against 6·52 and 6·55.

On the important subject of constant supply, the statistics appended to the report show that of the total of 1,061,428 services

in use on the 31st of March last, 1,021,502, or 96·24 per cent., were on the constant system; being an increase of 0·94 on the figures for 1905-6. In the Kent district, constant supply is given throughout, with the exception of some 300 services on Shooter's Hill; and this is to be remedied by a water-tower or tank to be erected on the summit, for the purpose of maintaining a constant supply in this district. The percentage on constant supply is 99·71. In the New River district, constant supply is given to the Metropolitan portion, and to the whole of the district outside the Metropolis, except parts of Enfield and Tottenham transferred under the Metropolis Water Act, 1902, as regards water supply, from the jurisdiction of the Urban District Councils to the Board, and except also a few houses in the village of Great Amwell. The percentage of services on constant supply in December, 1904, was 99·9. The figures for Tottenham and Enfield, first included in January, 1905, had the effect of reducing this percentage; but the added areas are being brought under the constant system as soon as practicable. The percentage on constant supply in the district is 94·10. As regards the southern district, in the Lambeth division constant supply is in contemplation for Thames Ditton. The percentage on constant supply in the division is 81·12. The whole of the eastern and western districts and the Southwark and Vauxhall division are on constant supply. The increase in the number of services on the constant system during the year was 27,276, or 2·743 per cent.

The rest of the report deals with storage, filtration, and other engineering matters, which may be left for another article.

MEANS OF ILLUMINATION IN RUSSIA.

Dealing with the announcement that the Russian Government has at last made up its mind to impose the tax on coal gas and electricity that has been talked about for a long time, Herr P. Martell wrote an article in a recent number of the "Zeitschrift für Beleuchtungswesen" which contains some interesting figures showing the consumption of gas, paraffin, and electricity in Russia at the present time. A tax on paraffin was imposed in 1887 at a time when the oil was affording about 94 per cent. of all the artificial light developed, and when the consumption was about 20 million pud, equal to a production of 76,800 million candle hours of illumination.

In order to collect the necessary information for calculating the amount of tax to be imposed, the Russian Government instituted certain inquiries during July, 1906, which cover all the districts of the country with a few exceptions, but do not include Finland. At the time when the replies were collated, there were 32 public and 95 private gas-works in Russia, which made altogether about 3317 million cubic feet of gas during the year 1906. Of this total, about 2800 millions were employed to generate light, the remaining 500 millions being used for motive and other technical purposes. At the same time, there were 132 public and 5326 private electricity stations which developed nearly 482 million kilowatt hours of energy. Of this total, 222 million kilowatt hours were used to afford light, and 260 millions were consumed for motive and other technical purposes. Comparing the individual figures relating to gas and electricity, it is interesting to notice that the commercial gas undertakings were providing 92 per cent. of the total gas manufactured, the private works only making 8 per cent. On the other hand, the public electricity generating stations were only developing 20·8 per cent. of the total current, the private plants generating 79·2 per cent. Even in the large towns fitted with public electricity supplies, the bulk of the current consumed was being made by owners of private plants. For example, in St. Petersburg some 72 million kilowatt hours were consumed in 1905, of which the private dynamos generated roughly two-thirds. In many of the large cities the public electricity supplies were only generating about 28 per cent. of the total current consumed, even when an allowance was made for the current taken by the electric tram lines. The total make of the public gas-works in Russia during 1906 was 3056 million cubic feet. Of this quantity, 1851 millions were supplied to private consumers for consumption in illuminating burners, 461 millions were employed in motors and for trade purposes, 686 millions were used in street-lamps, 56 millions were consumed to furnish light, and 1 million to afford power on the works. The private gas undertakings manufactured 208 million cubic feet for the production of light, and 54 millions to drive engines and do other work.

At the period under review, 56 towns in Russia, all of them being what are termed "Government towns," were provided with electric street-lamps; while 20 towns, 13 of which were Government towns, had gas-lamps. Nine towns were provided with both electric and gas lamps in the streets. Hence the majority of towns in Russia were still being lighted by means of paraffin. Even at St. Petersburg there were 5794 paraffin lamps in the streets in addition to 134 arc lamps, 1722 electric glow-lamps and 8446 gas-lamps. The consumption of electricity is increasing, but is not replacing paraffin or gas, as the Russian people are simply demanding more artificial light. At a time when the consumption of paraffin was 18·87 million pud, the population was 106 million; so that the consumption per head per year was 7·12 Russian pounds. By 1905, the consumption of paraffin had increased to 44·13 million pud, the population had increased to 144 million, so that the consumption per head was 12·25 Russian pounds. In other words, the population during the last two decades had increased by 30 per cent.; while the total consumption of paraffin had increased by 134 per cent., and the consumption per head by 72 per cent. Only about 1 or 2 per cent. of the paraffin was used for purposes other than the production of light. It may be calculated that the amount of light afforded by the paraffin consumed is now equal to 169,459 million candle-hours, which should represent about 50 per cent. of the total light developed in Russia.

The idea of the Russian Government is to impose a tax at the rate of 4 kopecks per B.T.U. on electricity consumed as an illuminant, and at the rate of 1 kopeck when the current is employed for other purposes; the total revenue being expected to reach 8 84 million roubles from the lighting current, and 2·60 millions from the remainder. The proposed gas tax is expected to bring in 1·1 million roubles from the gas consumed as an illuminant, and 0·1 million from that which is used for other purposes.

THE BAMAG GAS-LIGHTING APPARATUS.

Among the papers read before the last meeting of the Austro-Hungarian Association of Gas and Water Engineers, a description was given by Herr Schlegel, of Berlin, of the new distance gas-lighter, known as the "Bamag."

According to the text of the author's communication printed in "Gastechniker," the apparatus is one which turns up or down from any distant spot a burner fitted with a pilot-flame by means of a temporary increase in the pressure of gas. The appliance is constructed of a small cast-iron vessel divided into two compartments by a flexible diaphragm. One of the compartments is in communication with the gas service-pipe, while the other contains a spring impinging against the diaphragm which can be adjusted by the aid of a movable lever in such fashion that the spring takes the whole of the pressure of the gas upon the diaphragm. Hence alterations in the pressure cause the diaphragm to move one way or the other. The motion of the diaphragm is communicated to a system of levers, which ultimately move a mushroom valve on the burner-pipe. This valve is of such weight as of itself to close the gas-way when the gas stands at normal pressure, but to be lifted off its seat by any increased pressure. The manner in which the valve is moved through the agency of the system of levers depends on a special toothed wheel (the essence of the whole invention), which is caused to revolve by a ratchet. According to the position and depth of the indentations on the toothed wheel, two successive impulses, given either by loading the governor at the gas-works or by temporarily opening a bye-pass, cause all the burners fitted with the lighter first of all to be turned on and secondly to be turned down.

By fitting some of the burners on the same main with toothed wheels of one particular design and others with toothed wheels of a different pattern, it becomes possible to light all the gas-burners at the same time, but to extinguish those of one class before the others. This is effected by inserting in the apparatus attached to the burners which, for example, are to remain alight all night in the streets, such toothed wheels that the first impulse of all lights them from their bye-passes; the second impulse, which extinguishes certain other burners intended to be put out at the end of the evening, leaves the all-night burners untouched; while the third impulse puts out the latter, and does not affect the evening burners. Thus the all-night burners are affected by the first and third impulses, and untouched by the second; whereas the evening burners are affected by the first and second impulses, and are untouched by the third. The toothed wheels themselves, which are, of course, replaceable, are situated inside chambers secured by means of a key. Therefore, in the rare event of the lighter failing to act when an appropriate impulse is sent over the district, the wheel can be taken out by the attendant, exchanged for a fresh one, or moved round into the position it ought to occupy. It will be obvious that the Bamag lighter does not involve any second service pipe or pneumatic tube. It costs about 25 marks per lantern to instal, and in German conditions leads to an economy of from 6 to 8 marks per lantern-year, over and above the saving in gas due to the whole of the lanterns being lighted and extinguished simultaneously.

Herr Schlegel stated that 10,000 of the distance lighters referred to had already been installed in Germany, and had proved to work successfully. In Austria, 170 had been fitted at Villach, and 318 at Pola. The managers of the gas-works at both places had expressed their complete satisfaction with the installations.

Assessment of Gas and Water Works for Income-Tax.—According to the fiftieth report of the Commissioners of Inland Revenue just issued, the gross income assessed in respect of gas-works for the year 1905-6 was £7,413,611. Compared with the preceding year, there was a decrease of £192,919, or 2·5 per cent.; compared with 1896-7, there was an increase of £1,884,155, or 34 per cent. Water-works have shown a gradual increase from 1896-7 to 1905-6. In the latter year, the gross income assessed was £5,816,300, or £1,800,984 more than in the former one—being equal to 44·8 per cent. In the year 1904-5, the assessment was £5,327,082, or £489,218 less than in the succeeding year.

HOT-COKE CONVEYING PLANT AT THE PARIS GAS-WORKS.

Experiments with a Water-Jet Conveyor.

It may, with some degree of truth, be said that the problem of quenching and conveying hot coke, though it has occupied many engineering minds for a long time, has never yet been so fully and so satisfactorily solved as is to be hoped for. As is well known, and as our past "Register of Patents" testifies, the attention of inventors—or of those who file patent specifications (for the terms are not synonymous)—seems to be given at particular times to particular matters. The vogue of hot-coke conveyors may perhaps be put down as between the years 1890 and 1903. After the latter year, attention was directed more to improvements in stoking machinery and to the possibilities of vertical retorts. Had it not been, perhaps, for these later distractions, further mechanical skill might have been devoted to the difficulties of carrying hot coke, and the problem more perfectly solved than has been the case.

It may also be reasonably considered that the newer and more "pushing" forms of retort-discharging machines have given rise, to some extent, to different requirements and arrangements for dealing with the expelled hot coke, discharged as it is in one long, live stream from the retort. The newer stoking-machines necessitate newer conveying appliances. As the former were early and extensively experimented with by the late Paris Gas Company—more especially at their La Villette works—it is natural that the latter should also receive every trial at the hands of the engineers in the Paris Gas-Works. The columns of the "Journal" have, from time to time, contained references to hot-coke plants which have been put up in Paris, and elsewhere in France; and our attention has just been drawn to the latest experimental hot-coke conveyor which is being tried at La Villette works, and which may be called a "water-jet" conveyor; for the coke is quenched and carried along a trough by a swift-flowing stream of water.

We will describe it later in the words of M. Thibeault, an engineer of Arts and Manufactures, who has contributed an interesting article to "Le Génie Civil" of the 3rd inst., on the subject of "Coke Quenching and Conveying in Gas-Works." His paper is well illustrated, and we reproduce some of the newer diagrams given, as well as summarize certain of his statements.

Difficulties of Quenching Hot Coke.

Preliminary reference is made to the arduous work of drawing, dragging, tipping, and extinguishing incandescent coke from coal-gas retorts. The mere throwing of water over the coke is hard enough, as it is calculated that 65 litres of water are required for every 100 kilos of coke. This is roughly the equivalent of about 7 gallons per hundredweight. Further, the wheeling out of the coke to the yard represents about 15 per cent. of the retort-house labour; the carrying of water is approximately 7 per cent.; and the shovelling of the coke into heaps accounts for 12·5 per cent. This labour can be facilitated, as has been done at the Saint Mandé and Vaugirard works of the Paris Gas Company. The coke drops through hinged doors in the retort-house flooring directly on to a quenching pavement below. After being sprayed with water from a hose-pipe, the coke is loaded into carts standing at the lower side of the quenching platform. Apparently there are no mechanical appliances at these works; and in such places a shower coke-quencher is often useful. Fig. 1 shows an apparatus designed by M. Sainte-Claire Deville, and adopted throughout the Paris Gas Company's works. Its advantage is that it regulates the amount of water used according to the weight of coke to be quenched; and, further, it effects some considerable economy in the water consumed. After being placed in a dry

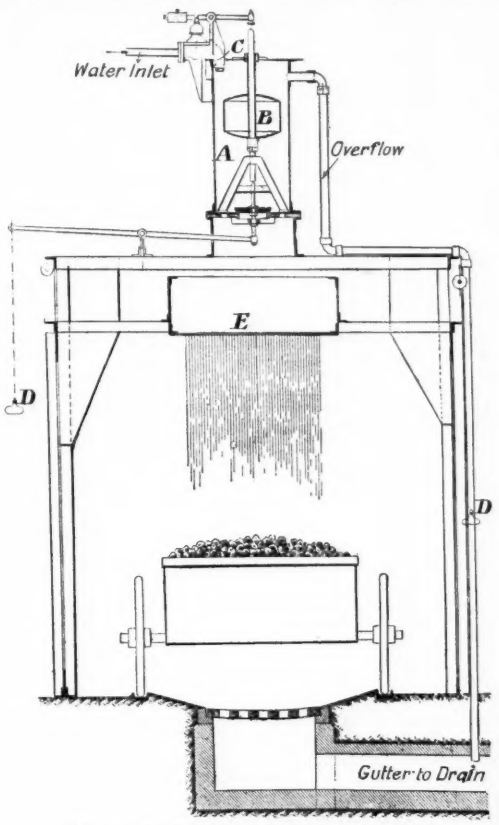


Fig. 1.—The St. Claire Deville Coke Quencher.

yard, the coke thus quenched does not contain more than 2½ per cent. of water. The apparatus consists of a measuring-tank A, in which a float B regulates the inlet water-cock C. The bottom of the measuring-tank is closed by an india-rubber valve. It is worked by levers and a chain D. During the emptying, the valve-shaft keeps the float raised, and thus the cock C is closed. When

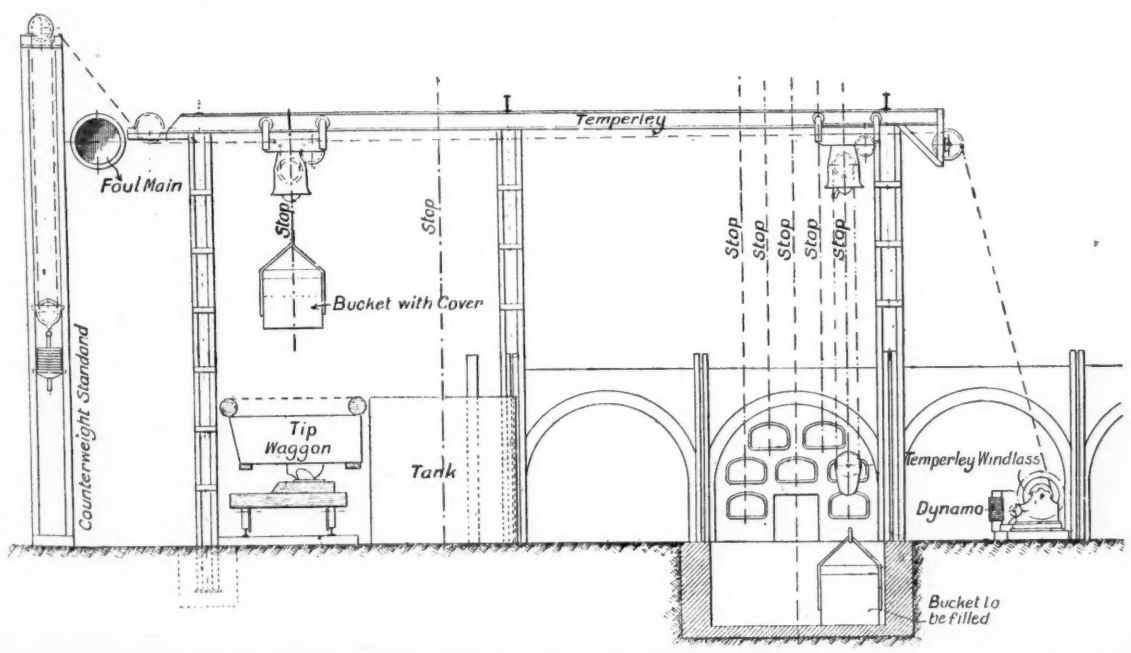


Fig. 2.—The Temperley Transporter Adapted to Carrying Hot Coke.

the valve is worked, the water from the measuring-tank runs rapidly into the box E, the bottom of which is perforated. The shower of water thus produced quenches the coke; any excess running into the gutter. M. Sar's apparatus, designed on similar lines, is also described and illustrated.*

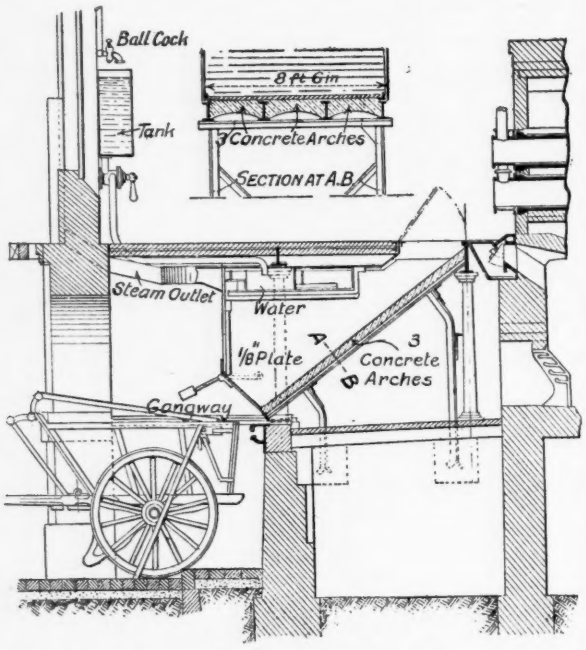


Fig. 3.—The Coke Quenching Closed Hopper at Vaugirard Gas-Works.

Paris Experiments with Hot-Coke Conveyors.

Mechanical coke-conveyors are then mentioned, the De Brouwer being given first place. Messrs. Graham, Morton, and Co.'s solution of the hot-coke problem, as carried out at the Nanterre Gas-Works, is incidentally referred to. At Mulhouse, the coke coming from inclined retorts falls into aërial buckets suspended from rails. They carry the incandescent coke, and deposit it in the yard. It is cooled principally by being spread out; quenching by water being supplementary. Such a system requires plenty of space, besides which the re-handling of the coke for breaking or loading is costly. The output of all these appliances is limited, and their upkeep is heavy. Especially is this the case when, as with the Paris Gas Company, the coke from a 6-metre (20-feet) retort has to be dealt with in 16 seconds—*i.e.*, the time taken to discharge the retort with a pushing-machine. What this means is shown by the following figures:—

	Carbonization in		
	Four Hours.	Six Hours.	Eight Hours.
Weight of coke.	210 kilos. (463 lbs.)	315 kilos. (694 lbs.)	425 kilos. (937 lbs.)
Volume of coke.	5·55 hectolitres	8·32 hectolitres	11·11 hectolitres
Calories	73,500	110,250	147,000

Numerous trials have been made by the Paris Gas Company with hot-coke conveyors, all directed to the end of reducing the arduous labour involved, and of obtaining large pieces of coke with the least possible dust, and with a quantity of water lower than 5 per cent.—the coke being at the same time perfectly quenched. One of the first attempts was with an adaptation of the Temperley transporter (see fig. 2). It carried the hot coke from the retort-house to a quenching-tank. The ordinary open bucket of this apparatus was replaced by one with spaced bars and with a cover. But the sudden immersion broke the coke; and there were difficulties with the water. Moreover, the passing overhead, on an aërial way, of a

* See "Journal," June 30, 1903 (Vol. LXXXII., p. 956).

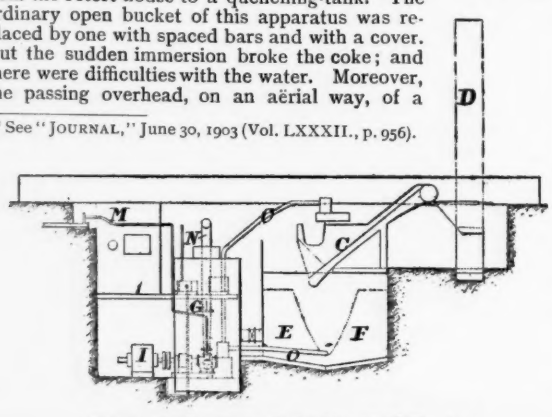


Fig. 5.—Section through the Line G H (Fig. 4).

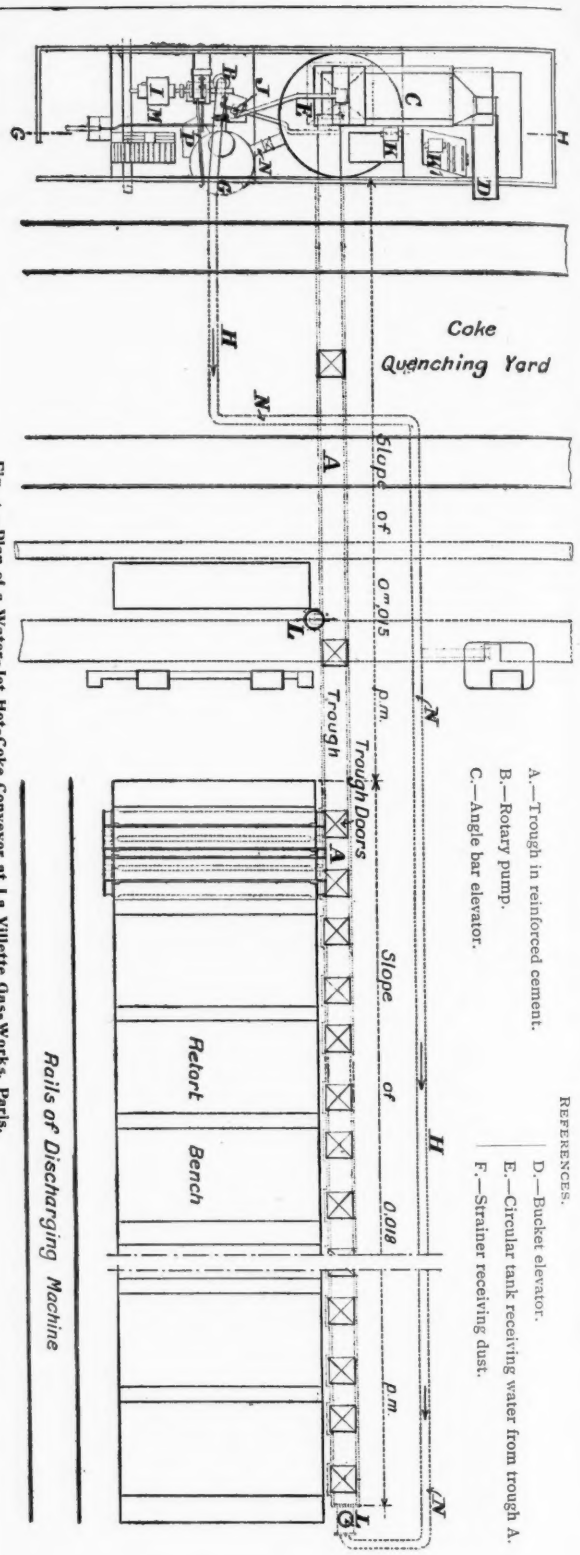

Coke Quenching Yard
Slope of 0m015 p.m.
Trough
Trough Doors
Slope of 0.018
Retort Bench
Rails of Discharging Machine
References.
A.—Trough in reinforced cement.
B.—Rotary pump.
C.—Angle bar elevator.
D.—Bucket elevator.
E.—Circular tank receiving water from trough A.
F.—Strainer receiving dust.
G.—Second circular tank receiving water from F.
H.—Pipe returning water to trough A.
I.—Electric motor.
J.—Pump taking out dust.
K K'.—Motors driving elevators C and D.
L.—Sheet-iron chimneys taking away steam.
M.—Supply pipe to tank G.
N.—Water suction and delivery pipe to trough.
O.—Dust suction and delivery pipe.
P.—Suction and delivery pipe of infiltration water.

Fig. 4.—Plan of a Water-Jet Hot-Coke Conveyor at La Villette Gas-Works, Paris.

bucket filled with hot coke was not desirable from the point of view of safety.

Another method tried was that of flat trucks moving parallel to the retorts being discharged. Outside the house, the coke was quenched in a water-tower, as the coke was being taken to an elevator which filled the waggons for the coke-breaking plant. The working of the trucks was complicated, more particularly in moving them in unison with the discharging of the retorts.

A movable quenching elevator of large capacity was also experimented with.* It received the coke direct from the retorts, and delivered it into the railway trucks, which took it to the coke-assorting plant. The coke was quenched while still in the elevator.

Lastly, at the Vaugirard Gas-Works, a quenching-box or hopper was arranged in front of a bench of retorts, as shown in fig. 3. The coke fell by gravity into this box, in which (it being shut) the coke was sprayed, and left for some moments in the steam-laden atmosphere. In vaporizing the excess of water, the coke was cooled. The quenching-box, indeed, was in substitution of spreading out the coke in the yard. By this arrangement, 210 kilos. (say 4 cwt.) of coke are quenched with 76 litres (16¾ gallons) of water with a stay of three minutes in the quenching-box. Remaining there for eight minutes, 60 litres, or about 13 gallons, of water are enough. The same amount of coke, if quenched in the open air, would require about 120 litres (nearly 26½ gallons) of water. The coke obtained is very dry, big, and of good appearance; but the arrangement necessitates a retort-house of several floors, so as to place the hoppers underneath. The system is high in first cost and in upkeep.

These different trials showed the possibility of improving the methods of conveying hot coke, its quenching, and loading into waggons, but not one of them solved the question practically and economically.

Quenching and Conveying by a Stream of Water.

Taking up an idea put out thirty years ago by M. Arson, it was thought that a strong stream of water might be utilized for conveying the coke to outside the retort-house, and also quenching it. An installation of this kind has just been finished, and is now in operation at La Villette works on a bench of eight beds, each of seven "through" retorts. Figs. 4 and 5, with the explanatory list of references accompanying them, will enable the general lines of the installation to be followed. There is a reinforced cement trough, A, 46 metres (151 feet) long, placed on the opposite side of the bench to the stoking machinery. This trough has a slope of 18 mm. per 1000 mm. along the front of the bench, and 15 mm. for the remainder. Inside the retort-house, the top of the trough is covered with sheet iron; doors being arranged in it on the centre lines of the retorts. The coke falling through these doors from the retorts is rapidly carried by the stream of water along the trough, and deposited in the hopper of a large elevator with angle bars C, on which it is completely quenched by a spray. Then the buckets of the elevator D take the coke and fill waggons which go to the breaking and sorting plant. The elevators C D are driven by special motors K, K¹. The water, after having been used for conveying the coke, falls into a round tank, E, of about 27 cubic metres (953 cubic feet) capacity. In it is a conical strainer, F, which collects all the dust formed. This is emptied by a special pump J. The water thus strained goes into a second reservoir G, 12 cubic metres (424 cubic feet) in capacity, from which it is returned by a rotary pump B, through the piping H into the trough A. The same water, which is continuously in motion, thus serves for quenching and conveying the coke from all the retorts of the bench. Quenching vaporizes a certain amount of water; and this is made up by adding water to the tank G from the works' water-main M. Two chimneys L are placed, one at each end of the trough, for carrying off the steam produced by quenching.

The quantity of water sent into the trough varies according to the speed of the pump B. This can deliver 450 cubic metres per hour. It is directly driven by an electric motor I, of 25 H.P. at 120 volts. The forcing height between the water level in the tanks and the highest point of the main is 2·22 metres (7 ft. 3½ in.). The speed of the water in the trough at the moment of discharging the retorts is about 2 metres (say, 6 ft. 6 in.) a second. The travelling speed of a De Brouwer conveyor does not exceed 200 to 300 mm. (8 to 12 inches).

When the coke falls into the trough, it is kept on the surface of the water by the phenomenon of calefaction. Being almost carried by the stream, it reaches the elevator C, but incompletely quenched. By the spraying which takes place on the elevator, it is possible to regulate the amount of water contained by the coke. It is to be observed that the mechanical arrangements adopted in this trial at La Villette are not definite; in fact, various appliances which were already on the works were utilized as well as possible. In any case, the system does away with large coke-drying yards; and as none of the apparatus comes into contact with incandescent coke, the cost of upkeep should not be very great. Such a system is capable of numerous applications. Among them is that of vertical retorts, with which the taking away of hot coke, arriving in bulk by successive strokes, is one of the most difficult inconveniences to be overcome.

In conclusion, it is said that the water-jet hot-coke conveyor solves in a very happy way the problem of manipulating large masses of hot coke, quenching it, and then conveying it to other parts of a coke-plant; and that the results obtained reflect very great credit on the engineers and their assistants who have contributed to it.

* See "Journal," Dec. 16, 1902 (Vol. LXXX., p. 1631).

THE "WILD" FLICKER PHOTOMETER.

Mr. Lancelot W. Wild calls attention to a flicker photometer for which he claims many advantages—among others, its perfect freedom from angularity errors, complete reversibility, great sensitiveness, minimum of fatigue to the eye, perfect shielding from strong light, and that all parts of the disc are the same distance from the lights.

In the course of his description of it, Mr. Wild says the photometer consists of a thin circular disc of white material revolving on its centre. The disc is divided into two equal portions—the one opaque and reflecting, the other translucent and diffusing—as shown in fig. 1. The two lights under comparison illuminate the opaque and translucent halves of the disc respectively. The disc is viewed by the agency of a mirror and telescope, as shown in fig. 2. As the disc revolves, the eye of the observer sees first a portion of the reflecting half of the disc and then a portion of the

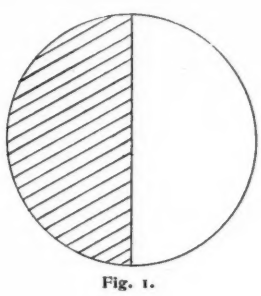


Fig. 1.

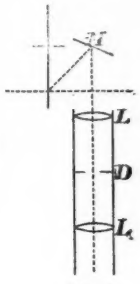


Fig. 2.

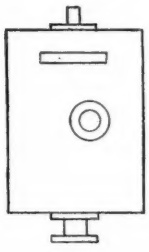


Fig. 3.

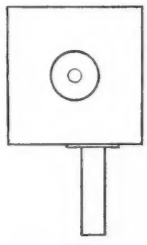


Fig. 4.

translucent half alternately, and in quick succession. If the two halves are not equally illuminated, a distinct flicker is observed every time the dividing line between them crosses the field of vision. This flicker totally disappears when they are equally illuminated. Inside the telescope is a diaphragm; and lenses are so arranged that the diaphragm is in focus when the disc is in focus. The eye is naturally focussed on the diaphragm, and is thus automatically focussed upon the revolving disc. This arrangement it is said reduces the fatigue to the eye to a minimum, and adds greatly to the sensitiveness of the instrument.

The disc being normally perpendicular to the rays of light falling upon it, a small deviation of the angle of the rays produces no measurable change in the illumination of either portion. In a photometer of the wedge type, or, in fact, in any form of photometer in which the surfaces to be viewed are inclined in opposite directions, Mr. Wild points out that the change of illumination due to a small deviation of the angle of incidence is very considerable, and gives rise to large errors in practice.

When the photometer is used with a secondary or intermediate comparison lamp, a single set of readings gives the correct ratio of illuminating power of the lights under comparison. If, however, it is required to compare two lights directly (without bringing in an intermediate or secondary standard), then two sets of readings must be made—the photometer being reversed before the second set is taken. The mean of the two sets gives the correct ratio between the lights under comparison. The reversal is effected by simply lifting the photometer box off its support, and turning it over. This reverses the disc, and the telescope at the same time, and is equivalent to reversing the lights.

The disc is driven by a small electric motor, which can be regulated to a nicety by means of a resistance. The motor runs on the current from a single accumulator or dry battery, or it can be run from the mains, whether direct or alternating current, in series with one or two lamps. In the former case there is needed an adjustable resistance in series with the motor, and in the latter case in shunt with it.

The disc is placed in the centre of a box, 6 inches long, with 2-inch holes either end, through which the light enters. It is, therefore, completely shielded from stray rays of light, except in

the direction of the lamps under test. The room can therefore be illuminated by lights overhead, so that the scale can be easily read, as well as any other instruments.

With this photometer lights of different colours can, it is claimed, be compared almost as easily and as accurately as lights of the same colour. The greater the difference in colour between the lights, however, the higher must be the speed of the motor.

The discs are very thin (less than $\frac{1}{16}$-inch), and, being perpendicular to the rays, there is said to be no residual flicker, after the best balance has been obtained, due to different parts being different distances from the lights. This, of course, increases the sensitiveness of the instrument. But though the disc is so thin, it yet runs dead-true—a result obtained by running it between guides fixed in close proximity to the part in the field of view.

Fig. 3 shows diagrammatically a front view of the photometer; and fig. 4 a plan.

EXPLOSIONS IN ELECTRIC LIGHT CULVERTS.

An Unsuspected Cause.

In the course of a paper read before the Liverpool Section of the Society of Chemical Industry by Dr. H. BASSETT, in which he described an interesting case of soil electrolysis, he cited some facts which may account for some of the explosions in street-boxes which are attributed to escapes of gas. The following are the portions of the paper, extracted from the Society's "Journal," specially bearing upon this subject.

Now that electricity is so largely used for lighting and power purposes, and wires conveying the current traverse the ground, especially in towns, in all directions, the effects of wandering earth currents, due to leaks from the wires, and earth returns on tramway systems, occasionally attract attention. These earth currents usually manifest themselves by causing the corrosion of metal objects, such as pipes, tramway rails, &c., placed in the ground. In such cases the object attacked acts as anode; the surrounding earth being the electrolyte. In other cases, where we are dealing with the opposite end—that is to say, the cathode—of the huge voltaic cell thus formed, alkaline deposits are found.

The following case, which was brought to my notice some months ago, may be of interest, as it shows the magnitude of the chemical processes which may be caused by such earth currents. A bad "earth" took place at the Brownlow Hill Workhouse, Liverpool. The leak occurred just under a small roadway, and, though the cable had probably been failing there for some time, the leak was only discovered from the fact that horses became restive at the spot owing to shocks which they received, and which, in fact, one could get by touching certain places. The cable affected was one supplying power to a motor at 460 volts. The current was carried by two thick insulated copper cables—a negative and a positive. These were laid about an inch apart on wooden bridges, in a wooden trough, which was then filled with bitumen; a wooden lid was finally laid over the bitumen. The trough was buried in porous sandstone—the top being about 18 inches below the surface of the ground. The leak had possibly been started by a heavy cart causing a crack in the bitumen, through which water had penetrated to the cable. Only the negative cable (which would be at 230 volts below the potential of the earth) was affected. This cable had been joined at the place where the leak occurred; the join having been bound round (perhaps not very carefully) with waterproofed cloth.

According to the clerk of the works under whose directions the leak was repaired, the material surrounding the leak was still so hot that one could only just touch it, though the current had been switched off for an hour and a half. It was found that the top of the wooden trough had been burnt through, and that a hard substance protruded through the hole thus formed and penetrated to the wire. This substance was so hard that it had to be removed with cold-chisel and hammer; and the workmen, to their surprise, caused big sparks during the operation. They also got rather burnt under the finger nails and on the face by flying chips of the evidently strongly alkaline material. The hard lump had been formed round the negative wire; but the metal was not at all corroded, neither had the insulation of the neighbouring positive wire been affected. The substance removed from the leak was collected, and the Engineer (Mr. A. J. Wilson), who had been much struck by its curious properties, asked me to investigate it.

The pieces brought me were dark grey in colour, very hard, very deliquescent, and strongly alkaline. If treated with a little water, small yellow or lavender flames were formed by bubbles of hydrogen catching fire. The mass evidently contained free alkali metal—in fact, on breaking a piece of the hard substance, the crevices in the interior were found to be filled with bright liquid metallic globules, evidently a liquid alloy of sodium and potassium. When these globules came in contact with water, they ignited, though the viscous alkaline liquid with which the lumps of the grey mass soon become covered on exposure to the air had very little effect on them. Analysis of the hard grey substance showed it to consist chiefly of potassium and sodium hydroxides, with a certain amount of the free metals. There was also a considerable amount of sand from the surrounding sandstone, as well as some silica rendered soluble by the action of the alkali, which must have been nearly fused during the passage of the current. It was quite free from carbonate, sulphate, chloride, &c., neither did it contain any metals other than sodium and potassium. A quantitative analysis gave the following results: KOH, 33·37; NaOH, 32·26; K, liquid alloy, 1; Na, liquid alloy, 0·80; soluble silica, 4·80; sand and earthy matter, 26·36; bitumen and water (by difference), 1·41. The composition of the alloy, as calculated from the above analysis, is 55·6 per cent. potassium and 44·4 per cent. sodium.

The formation of alkali by the electrolysis of the salts dissolved in surface water is, of course, not very surprising; but the quantity formed in the present case is rather astonishing when it is considered what a very small amount of potassium and sodium salts are present in soils. I had in my possession pieces of the alkaline mixture weighing in all 570 grammes; while from what I was told probably not less than 1000 grammes had been formed altogether. The surrounding bitumen for a short distance was also more or less impregnated with alkali. If the leak had not been discovered, but had been allowed to continue, the alkali would have eventually destroyed the insulation of the neighbouring positive wire, and have caused a short-circuit.

The alkali was, of course, formed by the potassium and sodium first liberated by the electrolysis reacting with water. This must have caused the evolution of a large amount of hydrogen. If this gas had been evolved in any position in which it could have accumulated and have got mixed with air, a violent explosion could quite easily have been caused, either by a light being brought near or simply by a globule of the liquid sodium-potassium alloy coming in contact with water and causing a spark. Many of the explosions in connection with electric light mains, usually attributed to accumulations of coal gas, are very possibly in reality due to hydrogen formed by electrolysis—a suggestion which was first put forward by Mr. Foulger at the Board of Trade inquiry into the explosion which occurred in the conduit of an electric light main in the Euston Road, London, on Dec. 29, 1894.*

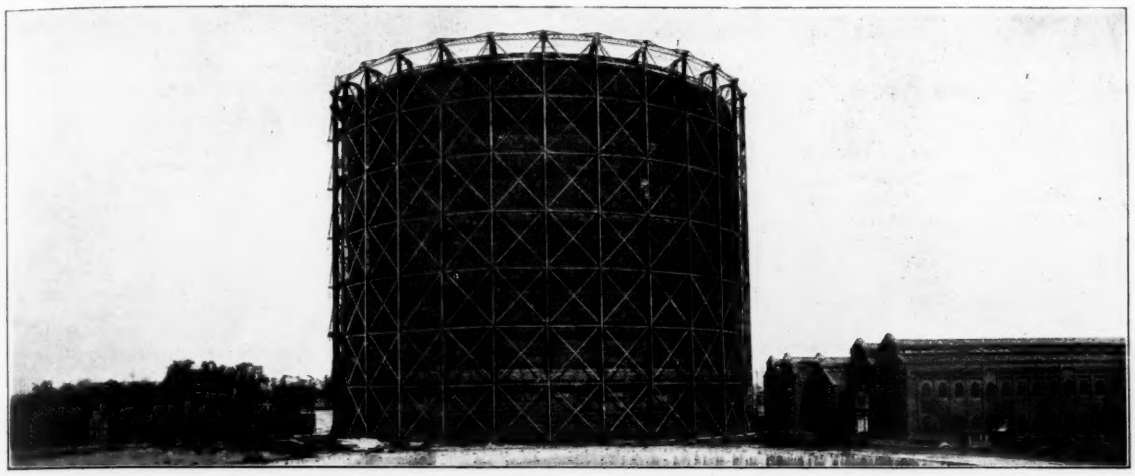
When I mentioned the above case of electrolysis to Professor Marchant, he told me he had recently been having some trouble with some of the switches on the basement walls of the electro-technical buildings of the University of Liverpool. White efflorescences had been forming on these and causing trouble. Professor Marchant gave me some of the efflorescence from one of the switches, and an examination showed that it was simply a mixture of 42·66 per cent. of potassium carbonate and 12·02 per cent. of sodium carbonate, together with water and a small quantity of alumina and silica. It was only the switches on the negative wires that were thus affected. It is plain that moisture had crept through the walls from the outside soil, and finally, on reaching the switch, electrolysis of the dissolved salts had occurred. Potassium and sodium hydroxides had thus been slowly formed, and been carbonated by the action of the atmospheric carbon dioxide. The formation of this efflorescence had been noticed for about two months, and by the end of that time it had become so bad that the switch had to be removed and replaced by a new one.

It is well known that the insulation of a positively charged wire tends to improve; while that of a negatively charged one nearly always deteriorates. This is due to the phenomenon of "electric endosmose," which drives the moisture (or electrolyte) away from the positive wire and towards the negative wire. It appears that on account of this "electric endosmose" about 99 per cent. of the faults which occur on direct-current networks occur on the negative wire. At all negative faults alkaline deposits or solutions are formed; and though it is known that these usually contain potash and soda, in only one or two cases do careful analyses of the products appear to have been made. In certain rare instances also the formation of free alkali metal has been observed.

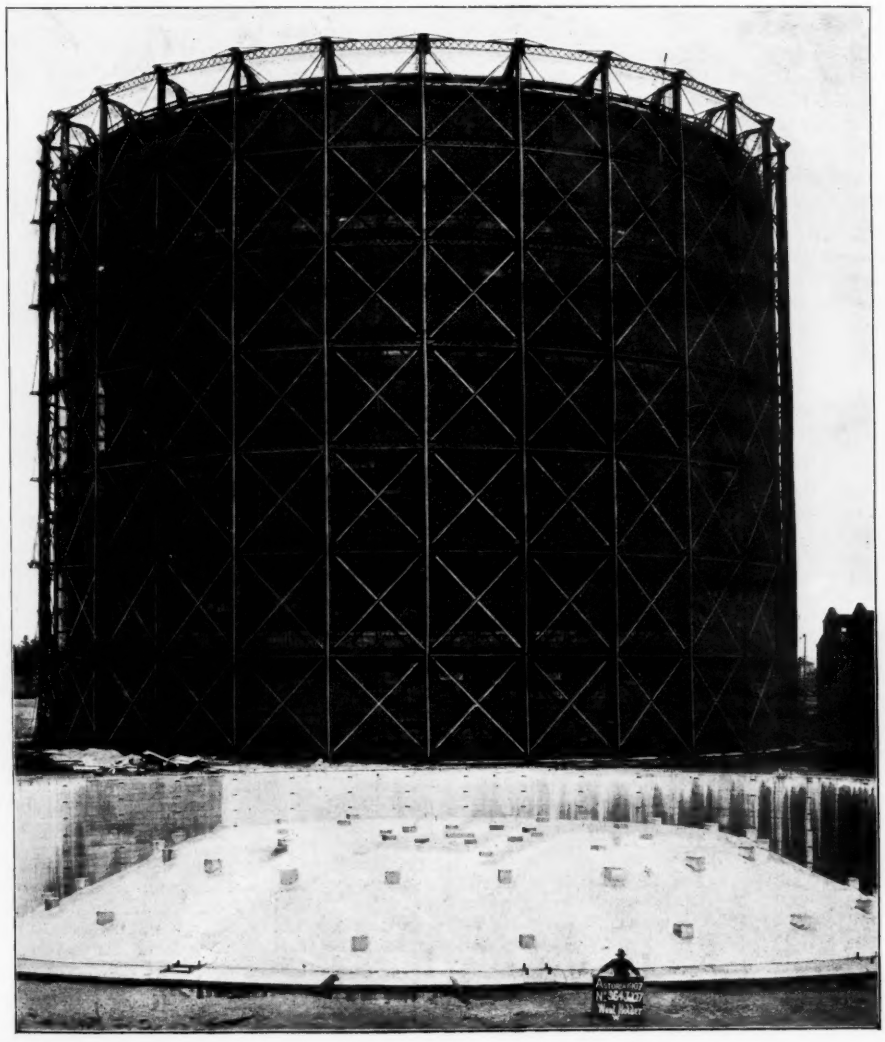
The first record of such a case that I have been able to find is in a letter to the "Electrical World" of July 6, 1889, in which an account of an "earth" in Boston (U.S.A.) is given. The "earth" in many respects was similar to the one recorded in the present note, for the cable affected was embedded in bitumen, and a hard lump was found at the fault, which flashed when wetted. Another case of the kind does not appear to have been noticed until 1895. In February of that year a serious explosion occurred in Euston Road in one of the conduits of the St. Pancras electric lighting system. Major Cardew, during his investigation of the affair for the Board of Trade, found incrustations on some of the insulators supporting the bare copper strips by which the current was carried. These incrustations gave sparks with water, and were found to contain free alkali metal, and it is plain that a fluid potassium-sodium alloy had been formed, as the metal is described as occurring in globules almost as fluid as mercury. As a result of Major Cardew's discovery, a Committee was formed to investigate the causes of the formation of these alkaline deposits. When the Committee inspected the St. Pancras mains (not quite at the place where the explosion occurred), they found an incrustation which flamed on treatment with water, but which in this case contained solid (not liquid) alkali metal. In the Committee's report is an analysis of the incrustation found on the cables near where the explosion occurred. It is as follows: Sodium hydroxide, 7·69 per cent.; potassium hydroxide, 4·88 per cent.; sodium carbonate, 34·4 per cent.; potassium carbonate, 52·77 per cent.; and traces of silica, alumina, and lime. Since 1895 numerous cases of alkali metal formation have been noticed; but I have not been able to find any other mention of an occurrence of the fluid alloy, nor any other analysis of the alkaline incrustation.

* See "JOURNAL," Vol. LXV., pp. 133, 326.

THE HOLDER AT THE ASTORIA WORKS OF THE CONSOLIDATED GAS COMPANY OF NEW YORK.



READERS will doubtless remember that in the autumn of 1904 we gave an illustrated description of the new gas-works at Astoria (New York) which were being put up for the Consolidated Gas Company by their Chief Engineer, Mr. W. H. Bradley. That series of pictures was sent to us by Mr. Bradley through Dr. A. H. Elliott, the Engineer-Chemist of the Company, who was then on a visit to this country. In a subsequent issue (Jan. 9, 1906), Mr. Bradley enabled us to give an illustration showing the progress made with the construction of the large gasholder tank at his works; and to-day we complete the series by the reproduction of two photographs of the holder sent by Dr. Elliott. They were taken at the first complete inflation of the holder, which will contain 15 million cubic feet of gas. Its location in regard to the other plant on the works will be seen on reference to the plan of the site which was given in the "JOURNAL" for Oct. 18, 1904 (p. 165); but it may be pointed out that to the right are the purifier-houses of the east and west sides of the new works—each side being complete in itself. The middle building of the five gables to the right is the meter-house. In the horizontal picture our readers will get a complete view of the new east gasholder tank, which is ready to receive the ironwork. Both pictures were taken by Dr. Elliott, who, we think it will be conceded, deserves congratulation on his success; the details of the holder being very clearly shown. It may be mentioned that a section of the new works was brought into use on the 3rd of December last, in quite an informal way, by the charging by Mr. Bradley of the first inclined retorts in a house containing 64 settings of nines. The gas produced in this house was pumped to the Ravenswood works at Long Island City, and sent thence by the East River Tunnel to New York, pending the completion of the holder, which it was expected would be ready by June. The expectation has been fairly well realized. We must once more express our thanks to Mr. Bradley and Dr. Elliott for enabling us to illustrate the interesting engineering features of the magnificent works with which they are both associated.



THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By M. Emile Sainte-Claire Deville.

[Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.]

The interesting communication which M. Sainte-Claire Deville the Manager of the experimental works of the Paris Gas Company, presented to the recent meeting of the International Photometric Committee at Zurich is a sequel to a communication which the same author presented to the meeting of that Committee in 1903, and of which an abridged translation appeared in the "Journal" at the time (Vol. LXXXIII, pp. 499, 567, 617). Nevertheless it is sufficiently independent of the earlier paper to form, apart from the latter, a consecutive and exhaustive report on a large number of investigations which M. Sainte-Claire Deville has carried out with his characteristic thoroughness and patience. But events in this country have moved too quickly for him; and his investigations, in so far as they relate to English methods of testing the illuminating power of gas, do not carry him later than the use of Sugg's "London" argand No. 1 burner, at the rate of consumption requisite for the production of a flame of fixed intensity—viz., 16-candle power. This method became obsolete in London when the provisions of the London Gas Act, 1905, came into force on Jan. 1, 1906, and is already comparatively little used in other parts of the country. Nevertheless, there is much of abiding interest to English readers in M. Sainte-Claire Deville's investigations; and the idea of preparing an abridged rendering into English of his communication has appealed to the translator, in that it will afford him an opportunity of presenting, by way of comments or addenda, a number of facts within his knowledge which may help to connect the observations of the author with the work of the English gas photometrician past and present. In order to avoid confusion, the translator's comments and notes will be distinguished from M. Sainte-Claire Deville's work by being put within brackets, or as foot-notes or separate paragraphs, as may be most convenient in each instance.

It seems desirable to point out that M. Sainte-Claire Deville incidentally remarks in a foot-note that he wishes it to be understood that his criticisms of customary photometric methods refer to them as scientific means of measuring the illuminating power of all gases which give luminous flames. As empirical checks intended only to determine whether a gas does or does not comply with certain closely defined and restricted conditions, he thinks they may be excellent. Unfortunately, the methods devised for the latter official purposes have been everywhere adopted for theoretical investigations on the variations of the illuminating power of gases. It is in respect of this extension of their application, which was not contemplated by their devisers, that he criticizes them.

First Memorandum (Dated Dec. 20, 1904).

THE ILLUMINATING POWER OF COAL GAS IN DIFFERENT COUNTRIES.

Introduction.

The President of the International Committee on Photometry has drawn the author's attention to the usefulness of an empirical table showing the agreement which subsists between the official standards of illuminating gas in France, England, and Germany. By official standards are understood: In France, the illuminating power defined by Dumas and Regnault, according to the agreement made in 1861 between the City of Paris and the Paris Gas Company. In England, the illuminating power defined in the Notification of the Metropolitan Gas Referees for the summer of 1899 (the mode of determining the illuminating power of gas which this definition involves was, in fact, first prescribed by the Gas Referees in their "Notification" dated May, 1898. By it, the gas had to be burnt in the standard testing burner—Sugg's London argand No. 1—at such a rate that a light of fixed intensity, viz., 16-candle power, should thereby be afforded). In Germany, the illuminating power defined by the Photometric Committee of the German Association of Gas and Water Engineers in June, 1898 (*vide* "Journal," Vol. LXXIII.).

It must be recognized at the outset that such a table can only show the agreement with approximate accuracy. Thus, if a gas tested in France and Germany has a valuation of 104 litres in France, and of 15 Hefners in Germany, it would not be right to conclude that another gas, having a different composition, which had the same valuation of 104 litres in France, would necessarily give the valuation of 15 Hefners in Germany. This depends on the fact that variations in the composition of the gas may not modify in the same degree the consumption of the (French standard) bengel burner for the intensity of one carcel on the one hand, and the intensity of the (German standard) Elster burner consuming 150 litres (5·3 cubic feet) per hour on the other hand. The numerical data relating to illuminating power of one country can be accurately translated; and even different standards of light are no obstacle, provided their relative values are known. But it is absolutely essential that the burner in which the gas is consumed for testing should be precisely the same everywhere, and should be used in the same manner. The suggested table of approximate equivalents, none the less, has a certain interest; and the author regrets that his manifold duties have not allowed him to carry out the programme of tests which he had arranged with a view to drawing it up. He has, however, thought that it would probably be useful to submit some extracts from old unpublished notes, dealing with the matter from an interesting, though slightly different, standpoint.

The notes start with an investigation in 1893 of the relation of Parisian illuminating power to the old English illuminating power. The tests then made showed that the percentage divergence between the illuminating powers of two particular gases is about twice as great if the valuation is made in English candles as it is if the valuation is in terms of the consumption for one carcel. This difference is enough to make all theoretical and practical researches on variations of illuminating power and their causes which have been made in one of the two countries incomprehensible and not capable of verification in the other.

This being recognized, the next question is which of these two "illuminating powers" is the more natural, or which ascribes to different gases values most in accord with their relative richness in hydrocarbons or their calorific power? The reply to this question is suggested in the conclusions of a general investigation on combustion in gas-burners made in 1880 to 1883. This investigation showed that it was easy, by carefully choosing an argand burner and supplying it with air artificially, to make sure of securing the maximum illuminating duty which a gas was capable of yielding, either for a stipulated consumption or a stipulated intensity. It is evident that this maximum duty, determined under identical conditions for all gases, can be considered to be the true or theoretical illuminating power. Now comparative measurements have demonstrated that while the theoretical illuminating power naturally always has a higher absolute value than the Parisian illuminating power, their variations are of the same relative order. Both are nearly proportional to the ratio of the air required for combustion to the gas in the case of maximum duty. These tests consequently displayed the superiority of the Dumas and Regnault method over the old English method.

What has to be said in this "First Memorandum" will be comprised in four sections and an appendix. Section I. refers to the comparison of the Parisian with the old English "illuminating power." Section II. defines absolute illuminating power, and describes the practical method of determining it. An appendix to this section quotes a paper prepared in 1883 on "A general study of combustion in gas-burners." Section III. gives a comparison between the absolute illuminating power, the Parisian illuminating power and the calorific power of the gas, and the proportion of air required for combustion in the case of maximum intensity of light. Section IV. comprises the author's conclusions.

Section I.—*Comparison of the Parisian with the Old English Illuminating Power.*

The intensity of the light afforded by a Sugg's "London" argand burner No. 1, consuming 5 cubic feet per hour, was measured in carcels, and translated into English candles by multiplying by the co-efficient 9·6. (This co-efficient, according to the resolution of the International Committee at this year's meeting, should be 9·8—See *ante*, p. 301.) There were 48 different samples of gas so tested, the chimney used being $1\frac{3}{4}$ inches diameter and 6 inches long; while 32 other samples were tested with the smaller chimney 42 mm. (1·65 inches—doubtless should be $1\frac{5}{8}$ inches) in diameter and 150 mm. (5·9 inches—doubtless should be 6 inches) long. The two series of tests gave analogous results, from the present point of view; and only the first series will therefore be now used.

It has already been pointed out that two gases of different composition may both have the same illuminating power according to the Paris system but different according to the English. The discrepancy may not be very great, but is greater than the possible error of observation. As a result, on plotting out the values for the 48 gases, the diagram shows an irregular patch instead of a line; but by sorting the values into six groups and taking the

means, the latter give almost exactly a straight line, which is the axis of the patch. From this line, an equation may be deduced by means of which the illuminating power of a gas, stated in English candles, may be calculated into terms of the consumption for one carcel, and *vice versâ*. Thus a table showing the approximate relation between the values may be prepared. The author is not at liberty to publish the actual values in such a table of the six groups of gases; but taking as the basis of comparison an average gas of the value of 105 litres according to the Paris method, then the divergences of the values under both systems of valuation for the different series of gases are as follows: (The differences are here stated in percentages below or above the value, according to the same system, of the average gas which is taken as the basis of comparison. A rather different method of stating the differences is used in the original.)

TABLE I.

—	Paris Valuation.	English Valuation.
Gas A, very poor	−10·6	−22·0
,, B, poor	− 5·8	−10·9
,, C, moderate	− 1·8	− 3·5
Average gas	—	—
Gas D, good	+ 1·2	+ 3·1
,, E, rich	+ 3·9	+ 8·1
,, F, very rich	+10·9	+21·6

The inconvenience which may arise from this difference in the valuation may be shown by an instance. Suppose an English gas engineer investigates in London the effect of some alteration in manufacturing conditions on the illuminating power of the gas produced, and finds that the alteration reduces the gas from grade E to grade C. The reduction is therefore from 100 + 8·1, to 100 − 3·5, or 11·6 on 108·1, or 10·8 per cent. A French engineer, astonished at the result, makes the investigation and finds the reduction to be from 100 + 3·9 to 100 − 1·8, or 5·7 on 103·9, or 5·48 per cent. only.

The opinion the two engineers form of one another, in consequence, may be imagined.

The situation was ameliorated, in so far as French and English conditions were concerned, by the alteration in 1899 in the mode of testing gas in London (*i.e.*, by the change from burning the gas at the fixed rate of 5 cubic feet per hour to burning it at the rate necessary to produce a flame of fixed intensity actually introduced by the Notification of the Gas Referees, dated May, 1898. The latter procedure continued valid in London up to Dec. 31, 1905. In 1906, the fixed rate of burning of 5 cubic feet per hour was reverted to, but another burner was introduced—Sugg's "London" argand No. 1, which had been prescribed by the Gas Referees from March 31, 1870, to the end of 1905, being superseded by Carpenter's "Metropolitan" argand No. 2.) But the German method of testing (*i.e.*, burning the gas at the fixed rate of 150 litres, or 5·3 cubic feet, per hour) continues on the lines of the old English system. Any tables of the relations subsisting between measurements made under different national systems can only afford a partial solution of the difficulty, for such tables prepared in London would differ from similar tables prepared in Paris, owing to the differences in the gas made in the two cities (*i.e.*, the presence of considerable quantities of carburetted water gas in much of the gas supplied in London). Confusion must prevail until the same testing burner is used in the same manner in both countries. Perhaps, however, it would be better to disregard the artificial quality known as "illuminating power," because the calorific power fully suffices for estimating the value of a gas from every standpoint.

SECTION II.—*Definition and Measurement of Absolute Illuminating Power.*

The least volume of air over and above the volume necessary for the combustion of the gas, which must pass through an argand burner in order to prevent the flame smoking, is called by the author the "obligatory excess" for that burner. It is very small for Sugg's "London" argand No. 1 burner, with chimney $1\frac{5}{8}$ inches in diameter and 6 inches long (in original 42 mm. by 150 mm.). One volume of gas of average composition requires 5·5 volumes of air for complete combustion, and that burner takes 6 volumes; so that the obligatory excess is only 0·5 volume. Let all the air consumed be supplied from a gasholder through a meter and desiccating chamber, so that it may be measured, and the burner be set up on a photometer. Open the air-supply tap freely, and then the gas-tap, and light the burner. By manipulating the two taps, the light afforded may quickly be made to equal 1 carcel, and then the air supply can neither be increased nor reduced without lowering the intensity of the light from the burner. So regulated, the flame does not flare; but it becomes smoky if the air supply is reduced by ever so little. Thus the maximum illuminating duty coincides with the minimum supply of air. Once the supply has been regulated, the consumptions of gas and air are observed and expressed in terms of the consumption per carcel, and its reciprocal—viz., the candle-power per 100 litres (3·53 cubic feet) of gas consumed per hour (or say, candle power per cubic foot). The latter value is a measure of the absolute illuminating power of the gas.

The ratio $\frac{\text{air}}{\text{gas}}$ or the volume of dry air consumed per 100 volumes of humid gas is an expression inherent to the gas tested, of which the variations in relation to the illuminating power have to be investigated. The volume of aqueous vapour which saturates the air at the temperature of the meter is deducted from the gross volume of air; so that the ratio is that of dry air to moist gas, both at the same temperature and pressure. These are the conditions under which the "absolute illuminating power" has been measured.

SECTION III.—*Comparison between the Absolute, the Paris, and the English Illuminating Powers, the Calorific Power, and the Proportion of Air Required for the Combustion of Gas.*

Comparative measurements were made in the latter part of 1893, on 46 samples of coal gas, of (1) the statutory Parisian illuminating power, (2) the absolute illuminating power, as defined, and the proportion of air for combustion, and (3) the gross calorific power, determined by the Mahler bomb. The specific gravity and composition of the samples were also determined, but are not dealt with here for the sake of brevity. The results have been grouped in eight classes, each comprising gases similar in character and quality. The results are stated in relation to the value, taken as 100, of statutory Paris gas (105 litres per hour per carcel) according to each mode of testing. The results are shown in Table II., to which a column has been added showing the old English illuminating power, calculated from the formula referred to in the introduction.

TABLE II.

Group.	Number and Nature of Samples of Gas.	Calorific Power.	Parisian Illuminating Power.	Absolute Illuminating Power.		Old English Illuminating Power (by Calculation).
				Light per 100 Volumes.	Proportion of Air.	
I.	1 from last stage of carbonization	− 33·2 per cent.	Nil	Nil	− 41·3 per cent.	—
II.	4 very poor, from third hour of carbonization	− 11·2 ,,	− 29·3 per cent.	− 30·7 per cent.	− 21·9 ,,	—
III.	14 poor	− 4·6 ,,	− 10·6 ,,	− 10·4 ,,	− 5·5 ,,	− 22 1 per cent.
IV.	7 moderate	− 1·4 ,,	− 2·9 ,,	− 2·1 ,,	− 1·7 ,,	− 6·0 ,,
—	Statutory Paris gas = 100	—	—	—	—	—
V.	10 good	+ 0·6 ,,	+ 2·2 ,,	+ 1·0 ,,	+ 1·4 ,,	+ 4·5 ,,
VI.	7 very good	+ 5·2 ,,	+ 9·2 ,,	+ 5·9 ,,	+ 7·1 ,,	+ 19·0 ,,
VII.	2 very rich, from first hour of carbonization	+ 29·1 ,,	+ 42·9 ,,	+ 34·5 ,,	+ 44·5 ,,	—
VIII.	1 extra rich, from first hour of cannel	+ 81·6 ,,	+ 110·5 ,,	+ 99·8 ,,	+ 179·3 ,,	—

Taking up the standpoint that the absolute illuminating power is the typical or standard illuminating power, then the photometric method which will show a proper and true relation between the lighting values of the different gases ought to give figures closely approximating to those for the absolute illuminating power. It is easy to see that in this respect the Parisian method is far superior to the old English method. This is explicable by reference to the behaviour of the two standard burners and their modes of use. The English Sugg burner has a very slight obligatory excess of air, and is therefore very sensitive to the further or contingent excess. When a very rich gas is consumed in it at the rate of 5 cubic feet per hour, the volume of air brought in contact with the gas by the draught of the chimney is exactly sufficient. The gas then burns without any contingent excess of air—that is to say, under the conditions under which it gives the best return. On the other hand, if a poor gas requiring less air is consumed at the same rate, the quantity of air drawn in by the chimney is as great as before, and furnishes a considerable contingent excess which destroys part of the illuminating power. Thus while rich gases are tested almost under conditions of maximum duty, poor gases are tested under relatively bad and inferior conditions, and are unduly depreciated. In the French method, however, the bengel burner has a considerable obligatory excess of air, and is consequently less sensitive than the Sugg burner to variations in the contingent excess. But, in particular, the contingent excess is not necessarily greater for poor gases, because the ratio of air to gas diminishes through the consumption of gas being increased in order to give the fixed light of 1 carcel. These considerations must have weighed with the English scientists who established in the year 1899 (actually in May, 1898) the

newer mode of testing which rests on the same principle as the French method.

Within moderate limits, such as those covering ordinary qualities of coal gas, the calorific power and the proportion of air to gas pretty closely follow the variations in the absolute illuminating power. But they naturally continue to have considerable values after the gas has ceased to have any "illuminating power."

The author is one of those who believes that in a few years' time the calorimeter will completely take the place of the photometer as an apparatus for valuing and controlling the quality of gas. In his opinion, therefore, it is no longer of use to try to improve and co-ordinate methods for determining the illuminating power of gas-flames. But if the International Photometric Committee think otherwise, he would suggest that they should direct their attention to giving an international definition of the illuminating power of gas-flames based on absolute illuminating power.

CONCLUSIONS (of the First Memorandum).

I.—Different illuminating gases, and coal gas in particular, are mixtures in an infinite variety of proportions of a large number of simple or compound constituents. The specific gravity, calorific power, and content of hydrogen, carbon, oxygen, nitrogen, and sulphur, can be measured with precision. They form specific properties, defined in the same terms in all countries. But the case of the illuminating power of the flames produced by the gases is different. In principle, the illuminating power of the flame or the lighting duty is the ratio of the intensity to the consumption per hour, and the units by which it may be valued can be reduced one to the other. But the ratio of intensity to consumption varies greatly for the same gas according to the manner in which it is burnt. Thus, in order to define the illuminating power of gas, the mode of combustion must first be settled.

II.—The mode of combustion acquires importance because there is no common measure between illuminating powers expressed according to different modes of combustion. For instance, two gases of the same illuminating power by the old English method may have illuminating powers differing one from the other according to the Paris method. The differences between the methods rest solely on the method of combustion in the testing burner and on the excess of air with which the gas is consumed in that burner.

III.—Experience proves that with all gases burners can be made of almost equal efficiency under these conditions: (1) Reducing the excess of air to its minimum—*i.e.*, to the proportion which is absolutely necessary to prevent the flame becoming smoky—and (2) choosing for effecting such combustion a burner in which the gas may be burnt without smoking with a proportion of air very close to that theoretically requisite for complete combustion. Experience further proves that the lighting duty of the gas thus burnt on the point of smoking is the highest duty which is compatible with the given power of the burner.

IV.—It is quite easy to attain this mode of combustion with the maximum duty by using an argand burner with artificial feed of air. The maximum duty or absolute illuminating power is very nearly what may be called the specific illuminating power of a gas. Other methods of valuing gas may be judged by reference to it as a standard.

V.—It has been ascertained that though the absolute illuminating power is higher than the Parisian illuminating power (by 18 to 20 per cent. for gas of average quality), the divergence between the two methods is not far different for the worst and for the best gas. Thus the Paris method justly assesses the relative values of different gases, and is therefore good. The old English method, on the other hand, enormously favours rich gases, and depreciates poor gases. It is more than likely that the method of the Committee of German gas engineers has the same defect. On the contrary, the newer English method presents more or less the same advantages as the Dumas and Regnault method, the principles of which it follows.

VI.—If it were still 1880, the author would strongly recommend the universal adoption of the measurement of absolute illuminating power, or a method based on the same principle. But on the eve of 1905, he finds thousands of incandescent gas-burners in the streets and shops of Paris and only half-a-score of flat-flame burners, and still fewer of the argand or Wenham type. He is convinced thereby that the International Photometric Committee should concentrate their efforts on consigning to the grave the idea of the illuminating power of gas-flames. The expression of absolute illuminating power has come too late to be of service.

VII.—It is evident that if the measurement of the illuminating power of flames is discarded, the determination of the calorific power of gas will be substituted for it as a criterion of the value of gas. It is certain that for almost all uses of gas other than lighting, calorific power is the essential gauge of value, as it is a measure of the energy contained in unit volume of the gas. The author endeavoured to show in his communication to the first session of the International Committee* that the lighting value of coal gas in an incandescent burner is very nearly proportional to the calorific power of the gas. There has still to be investigated whether a similar relation obtains with non-luminous gases, of which water gas is typical; and the author has such an investigation in hand. (It is reported in the sequel.) If calorific power fails to answer as a criterion of the value of gas for incandescent lighting, that value can then only be determined by an entirely new direct method.

VIII.—A method of this kind has been used by the author in investigating the relation between the lighting value in incandescent burners and the calorific power of coal gas. This method applies the principle on which the determination of absolute illuminating power was based. (It is described in the sequel.)

The use of burners with an artificial air-feed is highly instructive, and the author cannot too strongly recommend them to experimentalists on these matters.

[This is the conclusion of the author's first memorandum proper, though there is an appendix to Section II. in which a summary is given of five reports which he prepared betwen May, 1880, and July, 1883, dealing with the action of flat-flame and argand burners. It seems unnecessary at present to give further particulars of the contents of this appendix. In referring to the distinction which the author makes between the "obligatory" and the "contingent" excess of air supplied to argand burners, some explanatory matter from this appendix has already, for convenience, been incorporated in the foregoing summary of the contents of the memorandum proper.]

(To be continued.)

* See "JOURNAL," Vol. LXXXIII., pp. 499, 567, 617.

PRIMARY, SECONDARY, AND WORKING STANDARDS OF LIGHT.

By EDWARD P. HYDE.

[A Paper read before the Illuminating Engineering Society at their Boston Meeting.]

It is not my intention in this paper to present to you a history of primary standards of light, or to make a study of the relative merits of the various standards in use at present. It is my purpose rather to ask your consideration of a few very practical questions in connection with the relationship of primary, secondary, and working standards of light. By a "primary" standard is meant any standard that can be set up from written specifications —such as the Violle platinum standard, the Hefner lamp, or the Vernon Harcourt pentane lamp. By a "secondary" standard is meant a standard which, though not reproducible, will remain constant after having once been calibrated—the well-seasoned incandescent lamp is the best example of this. By a "working" standard is meant any lamp that is used as a standard in ordinary photometric measurements. It may be a secondary standard or even a primary one; but it is not necessarily either. Though the three classes of standards are quite separate in principle, they overlap in practice.

There is one quality which all standards must possess in common—they must have a suitable colour. This requirement is very indefinite; but it must needs be so. We cannot specify the actual spectral distribution; but we can exclude monochromatic sources. In other words, we can immediately eliminate some sources as being impracticable, whereas we cannot assign values relative to those which fall within the wide range of acceptability. In addition to this common property, there are special properties which each class of standards must possess.

A primary standard is good or bad accordingly as it is or is not reproducible. Its fitness as a primary standard depends upon the degree of accuracy with which it can be reproduced. It is not necessary that it should remain constant over a long period of use; the time at which the measurements are to be made can be specified, as is done in the case of the Violle platinum standard. It is not even necessary that it should be particularly inexpensive or simple, as it is sufficient that it should be set up from time to time in one or several of the various national standardizing laboratories now in existence. The only absolutely necessary qualification of a primary standard is that, in case all the secondary and working standards should be destroyed, the unit could be re-established. Of course, if a lamp can at the same time serve as a primary standard and a secondary or working standard, it is the more valuable. If it is simple and inexpensive, so much the better; but these are not necessary qualities of a primary standard.

In a secondary standard, we desire other qualities. These are best seen by keeping in mind an example—the well-seasoned incandescent lamp. A secondary standard need not be reproducible (we cannot make two incandescent lamps exactly alike); but it must remain constant after having once been calibrated in terms of the primary standard. It should be portable, simple, and inexpensive. Every standardizing laboratory should have secondary standards against which to measure the working standards of lamp manufacturers and testing laboratories.

The working standards should be adapted to the particular kind of testing in which they are to be used. In testing incandescent lamps, we want as working standards other incandescent lamps; in testing gas or oil, we want flame standards. Working standards should be portable, simple, and inexpensive; easy to manipulate; and of suitable intensity. But they need not be

reproducible. Having been standardized in terms of secondary standards, they should remain constant over a reasonably long period before having to be recalibrated or replaced.

With this brief statement of the requirements of primary, secondary, and working standards of light, let us inquire into the present conditions regarding these three classes of standards. First, is there a satisfactory primary standard of light? I think you will all agree with me that there is not. Many such standards have been proposed from time to time; and at present there are three or four such standards in actual use. This last fact in itself indicates that there is no one standard sufficiently superior to the others to warrant its general adoption. And if we look over the tables of relative values of these different standards, and compare the values found at one laboratory with those found at another, or those obtained in recent determinations with those accepted as the best of previous determinations, it is evident that there is an uncertainty in the ratios well beyond the limits of the error of measurement.

The situation with regard to secondary standards is quite different. It is generally conceded that the well-seasoned incandescent lamp meets every requirement of a secondary standard of light. The objection occasionally raised, that it changes with the time of burning, is not in my opinion as important as the changes which seem to take place at times when the lamp is stored away. A 4-watt per candle lamp, if properly seasoned, will not change appreciably—*i.e.*, more than two or three parts in one thousand in 50 to 75 hours' continuous burning. Since it only requires several minutes to measure an incandescent lamp, the standard lamp could be measured 500 or 1000 times before it would change appreciably in intensity. Since at the Bureau of Standards there are incandescent lamp secondary standards that are only used once or twice a year, it is evident that if only the change in candle power due to burning is to be reckoned with, the unit, in terms of which the secondary standards are expressed, could be maintained constant to within two or three parts in one thousand for several hundred years.

On the other hand, there seem to be much larger changes in the lamps from time to time while the lamps are not burning. Occasionally a lamp develops a bad vacuum; at other times a change in resistance is noticed—indicating probably an altered contact resistance between the filament and the leading-in wires. But apart from these changes in candle power, which are accompanied by changes in the electrical properties of the lamps, and which can probably be explained, there are apparent changes in intensity which are just over the limit of observational error, and for which we can offer no explanation. In determining the relative values of a number of incandescent lamps that have been inter-compared before, one of the lamps may seem to be high or low in intensity, with respect to the mean of the remaining lamps, by ½ per cent. or more. I do not mean that a single observer with one set of readings finds the lamp off by that amount—observational error might possibly account for that; but the mean of a number of sets by one observer agrees with the mean of a number of sets by another observer, in giving to the lamp a value somewhat different from that which it previously had. In another set of measurements, some time later, the lamp may come back to its original value. Whether these apparent changes are due to slight differences in the conditions of measurement at different times, or whether they are real changes in the lamps, it would be premature to say at present. They are small, however; and if a number of lamps are used, the mean value should remain sensibly constant over a long period.

The well-seasoned incandescent lamp is also an entirely satisfactory working standard in the photometry of electric lamps; but it is not suitable for use in gas photometry. It requires electric power to operate it, and electrical measuring instruments to control it; and these are usually not available, particularly in small gas plants. But, apart from its inconvenience, it is unsatisfactory. The intensity of a gas-flame is a function of the atmospheric conditions; and it would not be practicable to correct all measurements to standard conditions, as that would involve determinations, not only of water vapour and carbon dioxide, but also of the proportion of oxygen present in the atmosphere. In supplying gas, however, it is desirable for the manufacturer to state that the candle power of the gas furnished under normal atmospheric conditions would be up to the requirement. The way in which to determine this, without actually making the corrections, is to have as a working standard a lamp that is affected by the atmospheric conditions in the same way, and to the same amount, as the gas under test. If the intensity of the standard lamp under normal conditions is known, the candle power of the gas under normal conditions is obtained, immediately, by direct comparison with the standard lamp, independent of the atmospheric condition of the photometer room, provided it is uniform throughout the room.

The consensus of opinion among gas engineers is certainly that the working standard for gas photometry should be a flame standard. There seems to be less unanimity, however, in regard to what flame standard should be used. Candles are still employed to some extent in the United States and abroad; but recently there has been considerable advance both in this country and in England in the adoption of the Harcourt 10-candle power pentane lamp. In Germany the Hefner lamp is used now to a great extent in gas photometry, I believe; and in France the Carcel lamp continues to be used almost exclusively. But although flame standards have been, and still are, used in gas photometry, I do not know of any investigation of the relative influence of atmospheric changes on the gas and the standard lamp. It is scarcely justifiable to assume that the co-efficients are the same for two such flames as the pentane flame and the gas flame, which are controlled in entirely different ways. The pentane lamp is adjusted for flame height, whereas in much of the gas work the flame of the batswing burner is adjusted to a definite rate of consumption of gas by weight. Recently, in co-operation with the United Gas Improvement Company of Philadelphia, the Bureau of Standards made some experiments along this line in one of the Company's gas-testing photometer rooms in Philadelphia. Although these preliminary experiments were not carried far enough to warrant any very definite conclusions, they indicated that the two flames—the pentane and the gas—are affected in the same way, and to approximately the same extent, by changes in the atmosphere. Since differences of 8 or 10 per cent. in the intensity of the standard lamp may readily occur under normal working conditions, it is evident, if results of any accuracy are sought, it is not sufficient that the atmospheric conditions should affect the standard flame and gas-flame in the same direction; at the same time, the coefficients of change for the two should be nearly the same.

Another interesting fact in connection with the working standards in gas photometry is that, with the possible exception of the Carcel lamp (which, I believe, has been calibrated in terms of the Violle standard), all of the lamps used as working standards are at the same time primary standards. In the photometry of electric lamps, the seasoned incandescent lamp soon came to be used as the working standard, since the primary flame standards were not convenient; but in the photometry of gas, since a flame standard was desired, the primary standards came to be used as the working standards. Although this is a logical result, it is questionable whether it is the most satisfactory one.

Is it not possible that a cheap and portable lamp, which would remain constant in intensity after having been calibrated, might be found which would be more convenient and more easily manipulated than the Harcourt pentane lamp, for example? It does not follow that the lamp which best satisfies the requirements of both a primary and a working standard will satisfy the requirements of a working standard alone better than any other lamp. With authoritative testing laboratories available, where secondary standards are maintained, it is no longer necessary that the primary standards should be used in industrial photometry.

I have no such lamp to suggest as a working standard for gas, and it is possible that none can be found; but I think it is well to divorce the functions of the two kinds of standards. Reproducibility is the chief requirement for a primary standard, and constancy with burning is only a convenience. With the working standard, reproducibility is of no consequence. The lamp, however, should remain constant while burning, thus maintaining the candle power assigned to it on calibration. If the lamp which is the most reproducible is the most constant and convenient, then use it as a working standard; but do not confine the search for a working standard to those lamps which are reproducible.

The use of a primary standard as a working standard may, however, lead to a confusion of units between the gas and electric industries. This is exemplified by the situation in America at present. Both in the photometry of gas and of electric lamps, the intention was to use the British parliamentary candle. The American Institute of Electrical Engineers recommends obtaining the candle through the Hefner by the use of the ratio one Hefner equals 0·88 candle, which was supposed to be the mean value of the best determinations of that ratio. In gas photometry, the sperm candle (or more generally in recent years the Harcourt pentane lamp) has been used. It is definitely known now that the candle obtained through the pentane lamp does not bear to the Hefner candle the ratio of 1 to 0·88. From comparisons through electric lamps measured at the National Physical Laboratory in England and at the Physikalische Technische Reichsanstalt in Germany, the above ratio is found to be in error by 2 per cent. From direct comparisons of Hefner and Harcourt pentane lamps, the ratio appears to be in error by 4 or 5 per cent. If, now, both the gas and electric lighting industries adopted the same unit, which could be maintained at a national laboratory, and in terms of which working standards for both gas and electric lamps could be calibrated, "candle power" would have a single significance throughout the entire country.

The final step would be to agree with other civilized countries as to the value of the unit adopted, so that we might have in photometry, as in most other branches of physical science, an international unit. Although the German unit is so different from the others as to offer considerable difficulty to the realization of this plan, the units of England, France, and the United States are sufficiently close to warrant a compromise. This compromise would not entail the abolition of the present standards; it would merely necessitate assigning to the standards different numerical values. Thus the Carcel would no longer be 9·6 bougies decimales, but 9·5 or 9·4 international candles. Each country could maintain the unit through whatever standards it chose, primary or secondary, but by frequent inter-comparisons among the various countries, the unit would be maintained. Let the search for a suitable primary standard be continued, and may the time soon come when there shall not only be an international unit, but an international standard which shall take rank with the other international standards of modern physical science.

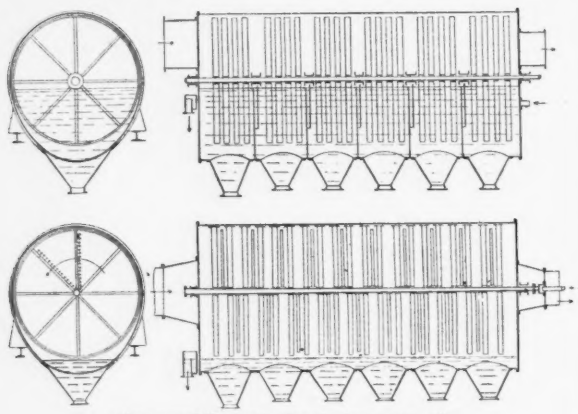
REGISTER OF PATENTS.

Cooling and Purifying Gases.

MEYER, A., and HASTERT, E., of Dudelange, Grand Duchy of Luxembourg.

No. 17,999; Aug. 10, 1906.

Hitherto, in order to cool blast-furnace gases for the purpose of using them as gases for heating or motive power, the patentees remark that two types of cooling apparatus have generally been employed. Those most generally used are cooling and washing towers with hurdles or gratings in which the gas to be cooled passes upwards through a vertical cylindrical vessel, while a finely-divided current of water circulates in the apparatus in the opposite direction, and absorbs a large part of the heat of the gas. A second type of cooling apparatus [that shown in the engraving] consists broadly of a cylindrical vessel in which there rotates a shaft carrying a certain number of circular sieves. The vessel is filled with water in such a manner that the rotary sieves are immersed in the water approximately to the axis of rotation, and therefore become re-charged with water at each revolution. The gas traverses the vessel in the longitudinal direction above the level of the water, and is obliged to pass through the close meshes of the sieves charged with water in such a manner that intimate contact is produced, and consequently an active exchange of heat between the gas and the drops of water upon the surface of the sieves. The water traverses the apparatus in the opposite direction to the stream of gas—this being obtained by suitable partitions. Simultaneously, some of the impurities contained in the gas are separated, and deposited upon the meshes of the sieves; and it is intended that this should be removed when the sieves enter the water.



Meyer and Hastert's Gas Cooler and Purifier.

Nevertheless, experience demonstrates that this takes place only if the water is pure. After a certain time, the water becomes charged with impurities to such an extent that it is no longer suited for washing the sieves.

In the improved apparatus, the sieves are assembled with the casing, and the partitions are entirely dispensed with, in such a manner that the impurities which float upon the surface of the water are able to escape freely through the discharge opening, and the level of the water is lowered in such a manner that the sieves no longer enter the water, and the whole of their surface may be utilized as a cooling surface. The sieves are sprayed by pairs of pipes, which proceed from a hollow rotary shaft and extend radially as far as the outer casing. These pipes are provided with spraying holes arranged in such a manner that, owing to the reaction of the water which escapes, the desired rotation of the shaft and of the entire system of spraying pipes is obtained. The total surface of the sieves is completely sprayed twice during each rotation, with fresh water under pressure. By this means, on the one hand, the entire surface of each sieve is uniformly covered with water; and, on the other, the particles of dust deposited by the gas in the meshes are constantly carried off by the washing.

The upper illustration shows in longitudinal and cross vertical section apparatus as hitherto generally used, with rotary sieves dipping almost up to their axes in water; the partitions forcing the water to pass through the apparatus in a zig-zag way. The lower illustration shows apparatus constructed according to the present invention. It consists of a cylindrical casing or vessel placed horizontally and provided at the bottom with funnels for emptying it by means of slides when required. A hollow shaft is connected by a stuffing-box or other suitable joint to a supply pipe which leads water under suitable pressure into the apparatus. From the shaft perforated branch pipes extend radially almost to the inner surface of the casing, perforated discs or sieves are arranged, firmly secured to the casing and surrounding the hollow shaft which loosely passes through it. One disc or sieve is placed at both sides of each branch-pipe. The spent water escapes by an outlet or overflow, the level of which is kept as shown, so as to prevent the discs or sieves from dipping therein. The gases to be cooled and purified are introduced at the left side of the apparatus, and escape at the opposite end.

Treatment of Gases for the Extraction of Ammonia.

FELD, W., of Hönningen-on-the-Rhine, Germany.

No. 18,505; Aug. 17, 1906.

This invention relates to the extraction of ammonia from gases containing ammonia—such, for instance, as coal gas and the like.

Hitherto such gases, the patentee remarks, have been washed with water in order to obtain ammoniacal liquors; but, in consequence of the volatile nature of ammonia, the resulting ammoniacal liquor has been very weak and a considerable amount of ammonia has been left in the gases—to an extent at least corresponding to the tension of the ammonia in solution at the temperature of the gases—and the ammoniacal liquor has been contaminated by sulphur and other impurities from the gases. In distilling this weak and impure ammoniacal liquor, not only does a considerable loss of ammonia occur, but part of the impurities (such as sulphuretted hydrogen) is distilled off with the ammonia, and the ammonia compounds produced are impure and of low concentration.

In order to obtain pure and concentrated ammoniacal liquors from which the ammonia can be produced by distillation in a concentrated and pure condition, the patentee proposes to wash the gases with a solution of a salt of magnesia, such as a chloride, a sulphide, a nitrate, or the like. In washing the gases with a solution of (say) sulphate of magnesia, under the simultaneous reaction of ammonia and carbonic acid, carbonate of magnesia and sulphate of ammonia are formed and sulphuretted hydrogen is absorbed. The ammonia is completely extracted from the gases; the strength of the ammonia sulphate solution employed depending on the strength of the magnesia salt solution used. On boiling this mixture of magnesia carbonate and ammonia sulphate, magnesia sulphate is regenerated, while carbonic acid and ammonia are distilled off—the ammonia being pure and concentrated. It is not necessary to boil till all the ammonia salt is decomposed, because the regenerated magnesia solution can be used over and over again for the gas washing process; and therefore the ammonia left in the solution after distillation is not lost, because it will be recovered at the next (or a succeeding) distilling operation.

The nature of the carbonate of magnesia formed by the action of the gases upon the magnesia salt solution depends on the molecular proportion in which carbonic acid and ammonia are in the gases. If the proportion be less than one to two, basic magnesia carbonate is formed; while if it be more than one to two, a mixture of basic carbonate with neutral carbonate (or even with bicarbonate of magnesia) is formed. The nature of this carbonate, or these carbonates, does not interfere with the completeness of the extraction of ammonia.

The washing process may be carried out in any suitable washer; the resulting mixture of magnesium carbonate and ammonia salt being muddy. The "most suitable washer" is said to be that described in patent No. 11,206 of 1905.

The following is an example of how the invention may be performed—magnesium chloride being taken as the salt of magnesia employed for the absorption of ammonia, and ammonium chloride being taken as the salt used to prevent the precipitate of carbonate of magnesia from becoming too thick or stiff. From 150 to 250 grammes of magnesium chloride and from 50 to 150 grammes of ammonium chloride are dissolved in 1 litre of water; but other proportions and consequent concentration may be used—the quantity of salts employed depending on the amount of ammonia to be absorbed. The gases may, for instance, contain 1 molecular proportion of carbonic acid to 2½ molecular proportions of ammonia. On the gas being passed through the solution, ammonia and carbonic acid will be absorbed and magnesium carbonate will be precipitated. After nearly all the magnesium salt is decomposed, the mixture is run into the distilling apparatus and heated. First carbonic acid will distil off—this containing the more ammonia the higher the temperature rises. With the distillation of the ammonia the precipitate of magnesium carbonate diminishes; chloride of magnesium being regenerated at the same time. It is not necessary to boil so long that all the ammonia salt is decomposed, as the liquor can be re-used for absorption, even if there be left in the solution as much as 20 per cent. or more of the ammonia. After being cooled to such a temperature that no further ammonia distils off, the liquor can be re-used for absorption. The presence of the excess of ammonia salt added to the magnesium salt in the solution prevents the liquor from getting too thick or stiff, either in the absorption apparatus or in the distilling apparatus.

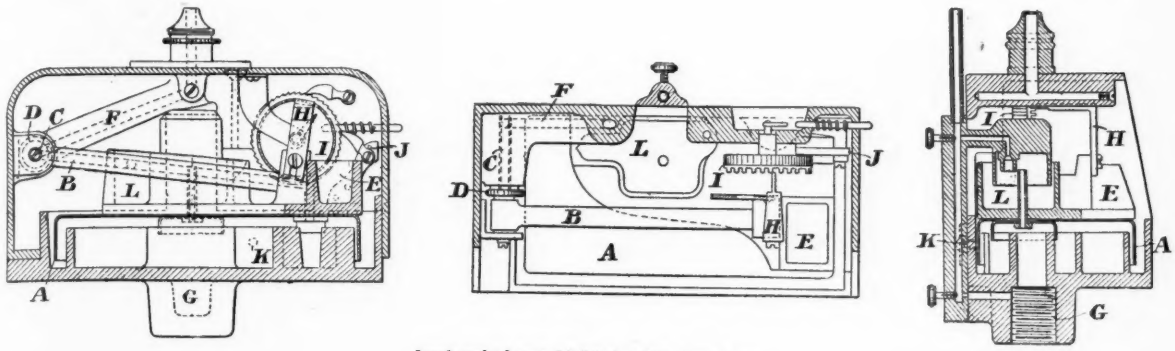
Gas Lighting and Extinguishing Apparatus.

JACOBSEN, J., of Elsinore, Denmark.

No. 21,247; Sept. 25, 1906.

This invention has reference to apparatus for lighting and extinguishing gas-flames of the type comprising a reservoir or diaphragm which floats in quicksilver, and is provided with means for rotating a cog-wheel, which latter influences the movements of the reservoir to cut off the supply of gas to the main burner; this being effected through the agency of either the first or the second lowering of the pressure in the main, after the ignition of the burner is caused by an increase of pressure. The pressure of gas in the mains may be repeatedly increased and diminished without the apparatus opening for the inlet of gas, whereas this takes place when the predetermined number of changes of pressure prescribed for the respective apparatus have been made. It is also possible to let the supply of gas continue until a certain number of diminutions of pressure have taken place. It is thus possible from the gas-works to fully control all the lamps—*i.e.*, to light all of them or one or several groups of them, and also to extinguish certain groups of lamps, while other groups remain lighted, and finally to extinguish these.

To the casing of the apparatus is screwed a bottom with channels containing quicksilver, in which floats a bell A in connection with a pipe B opening therein at one end, and having its other end connected to a pipe C, turnable in a bearing in which is a stuffing-box D. Upon the top of the reservoir is a chamber E, in which small shot and the like can be placed to regulate the load of the reservoir. The pipe C discharges by a hole into a canal F, to which is screwed a pipe on which the gas-burner is placed. In the bottom of the apparatus is also provided an inlet-opening G for the gas. On the pipe B is arranged an angle-arm H, turning upwards and bearing a tooth. Within the casing of the apparatus is a wheel I, which has ratchet-teeth on its periphery, and at the side bears a flange cut away to form a second set of teeth, and against which the tooth on H either strikes or with which it gears, according to the movement of the reservoir A. Arranged on the reservoir is a fitting J with a pawl which points upwards, and is revolvable on a screw-pin, and which, when the reservoir A is lifted, will rotate the wheel I, whereas this will remain



Jacobsen's Lamp Lighter and Extinguisher.

stationary while the reservoir is lowered. In order to prevent the wheel I from turning back, there is arranged on a peg a pawl which is movable around a screw.

To operate the apparatus, the quicksilver is filled in until it is discharged through the opening K and the bye-pass flame is lighted. If the pressure is increased, the reservoir A and the pipe B will be lifted, whereby the wheel I is revolved. If it is not intended thereby to light the lantern, the cog-wheel must beforehand be constructed in such way that the tooth on H pushes against one of the teeth of the cog-wheel; and the lamp will then only be lighted after the pressure has been diminished and is then again increased, as the tooth will go between two teeth on the cog-wheel. If it is intended to light the lamp by the first increase of the pressure, the ratchet-wheel must be constructed in such way that the tooth can at once pass through. For lamps which are to be extinguished by the first diminution of the pressure, the interval between the corresponding teeth on the cog-wheel must be so large that the tooth on H on the way back again can pass between the teeth. If, however, the lantern is to remain lighted in spite of the diminution of the pressure, the ratchet-wheel must, by its continued rotation during the lifting of the reservoir, at last show a flange tooth below the tooth, so that this, when the reservoir is lowered, will strike against the cog-wheel, and stop the lowering of the reservoir, whereby the introduction of gas is continued without any hindrance. When the necessary higher pressure is again produced, the wheel will rotate, and by ensuring diminution of the pressure the reservoir can get quite down, the pipe B immerses in the quicksilver, and the inlet of gas is interrupted.

When the reservoir A is lowered, the gas will pass to the bye-pass or lighting-flame; and if the main flame is to be lighted, the reservoir A is lifted, and thereby the reservoir L. The quicksilver in the reservoir L will thus be immersed, and thereby the inlet of gas in this way to the lighting-flame is interrupted.

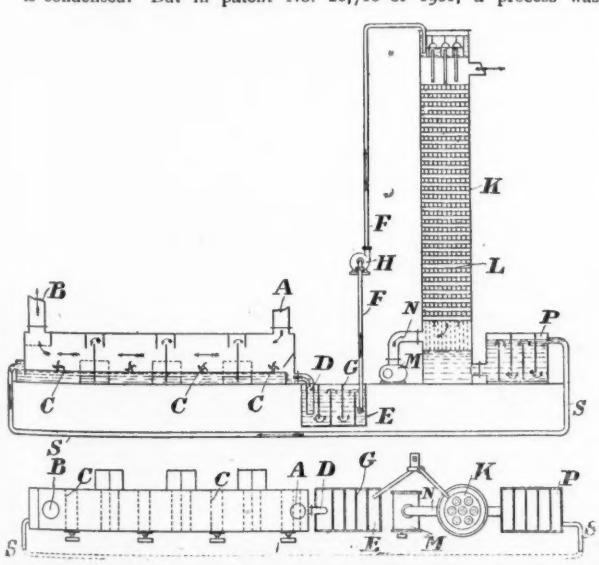
Ammonia-Recovery Gas Plants.

CROSSLEY, W. J., and RIGBY, T., of Manchester.

No. 24,144; Oct. 30, 1906.

This invention, relating more particularly to producer gas plants, is designed with a view to recovering ammonia.

In such a process, in order to obtain a large yield of ammonia, it is desirable to work the producers at a low temperature; and this is usually done by arranging for a large quantity of steam to be mixed with the air passing through the producer. A portion of the excess steam passes through the producer undecomposed; and "to make the process an economic success, it is not only necessary to recover the ammonia, but it is essential that the great quantity of latent heat present in the water vapour should be recovered from the gas." In most of the processes employed the ammonia is recovered at a temperature above that at which the water vapour is condensed, and before it is condensed. But in patent No. 20,716 of 1901, a process was described which "was calculated to simplify methods hitherto in use by condensing the water vapour and tars in the gas before the ammonia was absorbed." This was done in a special way, and the plant was considerably simplified and the process made easier to work.



Crossley and Rigby's Ammonia-Recovery Plant.

The object of the present invention is to still further simplify the process; and, instead of recovering the latent heat of the water vapour separately and the ammonia separately, the operations are combined.

In the earlier process, the washer employed was split up into compartments, with the object of making zones of temperature; the water contained in the washer travelling constantly in the direction of the hottest end. This hot water was then pumped through an air-saturating tower, with the object of saturating the air supply to the producers with water vapour and cooling the water—the cool water flowing back to the coolest end of the washer and then re-circulated. The apparatus was also arranged in such a manner that the ammonia was not lost—being passed onwards with the gases to an ammonia-absorbing tower. In the present invention, sulphuric acid is added to the water circulating in the washer in such quantities that there is always present in the liquor a small amount of free acid; and thus a fairly concentrated solution of sulphate of ammonia is obtained and circulated instead of water. The actual sulphate liquor thus becomes the medium for interchanging the heat of the gas and the water vapour condensed, and also washes the gas; the small percentage of free acid present in the liquor absorbing the ammonia in the gas. The water vapour from the gas condensed by the liquor in the washer is added to this liquor, and is more or less afterwards recovered in the air-saturating tower; portions of the liquor being taken off as required for further concentration by evaporation and crystalization in the usual manner.

In operation, the gas, after leaving the gas-producers and air superheating apparatus, enters the washer at A, and, passing into the first compartment, meets the spray raised by the paddle in this compartment. As it passes on (as shown by the arrows) into each successive compartment, it meets the spray raised by the paddles in each compartment—finally leaving the washer at B. The temperature in each compartment varies; the liquor flowing along the bottom of the washer in the opposite direction to the gas. The heated liquor leaves the washer by means of the sealed pipe D and enters the hot well E suitably arranged with baffles G.

The pump H is arranged to raise the liquor in the pipe F from the hot well to the top of an air-saturating tower K, whence it is distributed uniformly down the checkerwork L with which the tower is packed. Air from the blower M enters the air-tower at N, and is blown through the checkerwork in the opposite direction to the down-coming circulating liquor, and leaves the top of the air-saturating tower K saturated with water vapour. The circulating sulphate liquor leaves the foot of the air-saturating tower considerably lower in temperature, and passes into the baffle-box P, whence it flows by gravity, along the pipe S, back to the cool end of the washer to be again circulated, and so on continuously.

The patentees say they find in practice that any ammonia contained in the tar or other impurities brought down in the washer is absorbed by the sulphate liquor, so that practically all the ammonia contained in the gas is recovered and converted into sulphate of ammonia. A greater yield of ammonia per ton of fuel can thus be obtained.

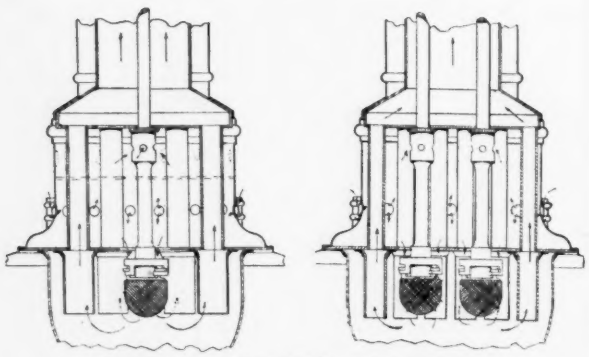
Inverted Incandescent Gas-Lamps.

DEUTSCHE GASGLÜHLICHT AKTIENGESELLSCHAFT (AUERGESELLSCHAFT), of Berlin.

No. 26,767; Nov. 24, 1906. Date claimed under International Convention, Nov. 28, 1905.

This invention relates to regenerative incandescent gas-lamps having one or more inverted burners, and in which the external air to support combustion is supplied directly to the incandescent bodies from a preheating chamber arranged in the lamp-casing; the supply being in the direction of the current of gas supply to the burner through openings in the base of the chamber, and the drawing away of the gases of combustion taking place through separate passages grouped round the burner tubes, and carried into the uptake chimney through the preheating chamber for the air.

The passages through which the gases of combustion are drawn away are carried downwardly into the globe space surrounding the incandescent bodies to about the level of their lower edge when suspended in the globe which surrounds them. This arrangement is said to present in many respects important advantages. The incandescent bodies can be so arranged as to be easily accessible, and there is therefore no danger of their being injured by the replacing and removal of the cylinders over them. The illuminating effect is, it is claimed, increased to the extent that the rays of light do not have to pass through a cylinder surrounding the incandescent bodies, but for the greater part emerge directly through the outer globe of the lamp.



German Forms of Inverted Incandescent Lamps.

In the engraving, two forms of this improved inverted burner lamp are shown in central vertical section.

In the first one, there is arranged a burner comprising a mixing-device, mixing-tube, and burner-head, with incandescent suspended body. The mixing-device is in a chamber into which the air enters from outside through openings. In this construction, the passages for the combustion gases extend through the air chamber, and communicate at their upper ends with the chimney which surrounds the gas-supply pipes, and at their lower ends are prolonged downwards into the space of the globe by means of tubular sockets. These sockets may preferably be removably attached to the base of the air chamber; they may also in some cases be formed in one piece with the passages. The lower mouth or edge of the tubular extensions extend to approximately the same level as the lower end of the incandescent body.

In operation, the air flows through the openings, as shown by the arrows, into the air-chamber, whence it is conveyed, on the one hand, to the mixing-devices and, on the other, passes through openings into the interior of the globe. The air receives a preheating in the air-chamber through the heating action of the passages, and a further preheating through its flowing past the mantle-suspending devices—the latter being simultaneously cooled. The air preheated in this manner flows downwardly into the globe space surrounding the incandescent body, and afterwards escapes upwardly into the chimney through uptake passages. This arrangement, "owing to the axial carrying-off of the hot gases, in addition to the advantages already set forth, presents the further advantage that heating of the globe is substantially lessened."

In the construction shown, the burner is arranged in the middle of the lamp, and is surrounded by a series of uptake passages, all of which are prolonged over the suspension means by tubular continuation pieces; the arrangement being such that the preheating of the air in the air-chamber is favoured. In the second form, however, a plurality of burners are arranged in the middle of the lamp, and surrounded by a ring of uptake tubes with the corresponding prolongations. This arrangement enables the incandescent bodies to be brought into as close as possible proximity to each other, and a concentration of the source of light to be thereby attained.

APPLICATIONS FOR LETTERS PATENT.

18,159.—Mouneyrat, A., "Burners for lighting and heating." Aug. 10.
18,170.—Claussen, F. G., and Romolo de Fazi, "Manufacture of a combustible gas." Aug. 10.
18,196.—Armstrong, J., "Manufacture of coke and gas." Aug. 12.
18,254.—Wolf, L., "Gas cooling apparatus for gas producing plants." Aug. 12.
18,292.—Barnes, F. G., "Tar spraying and road brushing machine." Aug. 13.
18,298.—Carter, A. E., "Street lamp." Aug. 13.
18,324.—Bayes, R. J. H., and Hill, A. B. L., "Generating acetylene gas." Aug. 13.
18,356.—Evered and Co., Ltd., and Read, E. T., "Gas-valves," Aug. 14.
18,376.—Bristowe, F., and Stapley, A., "Heating tar and spreading same on roadways." Aug. 14.
18,415.—Humphrey, A. H., "Gas-lamps." Aug. 14.
18,424.—Lewis, J., "Lighting incandescent gas burners or lamps." Aug. 15.
18,433.—Mitchell, T. H., "Gas-engine." Aug. 15.
18,446.—Yarrow and Co. (Bolton), Ltd., and Yarrow, M., "Joints of pipes or mains." Aug. 15.
18,469.—Zimmer, G. F., "Conveyors." Aug. 15.
18,476.—Friend, J. E, "Gas-engine." Aug. 15.
18,506.—Willocq-Bottin, E., "Acetylene generators and the like." Aug. 15.
18,524.—Chandler, S. & J., "Grids or hurdles for purifiers." Aug. 16.
18,553.—Stevens, C. R., "Gas or liquid fuel boiler." Aug. 16.
18,555.—Dix, C., "Opening and closing gas or other valves." Aug. 16.
18,561.—Mount, L. de B., "Gas-producers." Aug. 16.
18,567.—Buck, J., and Them, H., "Acetylene-generators." Aug. 16.
18,590.—Kautz, M., "Gas blow pipes." Aug. 16.
18,649.—Koffler, H., "Generating acetylene gas." Aug. 17.

At the monthly meeting of the Heywood and Middleton Water Board last Thursday, it was reported that the total expenditure on the Ashworth Moor new reservoir, &c., up to July 31, including £32,078 for lands purchased and interest during construction, amounted to £204,983, exclusive of £6580 for plant.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Gas Centenary: Sliding-Scale and Auction Clauses.

Sir,—I note the letter in your last issue from Sir George Livesey on the above; and, in view of the publication of the "history" in book form, I welcome his criticism and correction, "so that the proposed republication may be as accurate as possible."

Taking the Sheffield and West Ham Companies sliding-scales and putting them on one side on account of their incompleteness and imperfect character, London can claim to be the originator of a true both-way sliding-scale as applied to gas companies. That being so, the father of the sliding-scale is Sir George Livesey, who, as I stated, "at a meeting of the British Association of Gas Managers in 1874 dealt warmly with the question, and strongly advocated an up-and-down unlimited scale, giving an increase of dividend for every reduction of price below, and making an increase for every rise in price above, a fixed limit." It is true that, owing to the defective nature of the 1869 and 1874 one-sided sliding-scales of the before-mentioned Companies, they are no longer operative.

With regard to the auction clauses, I have always understood that the Commercial Company took the sliding-scale in 1875, when the other Companies refused it; and the words in my "history" are from the parliamentary proceedings on the Metropolitan Gas Companies, 1889—viz., "Treated with some favour by Mr. Foster's Committee in 1875, because they took the sliding-scale when the other Companies refused it in that year. Mr. Foster in consideration did not impose the auction clauses upon them."

Sir George, speaking at this date of his introduction of the sliding-scale, said: "Strange to say all the Companies (mine included) refused the sliding-scale in 1875. Except the Commercial, the whole of the Companies were against me." I am glad of the correction and additional information.

In compiling this history, I have in no wise gone out of my way to introduce the name of Sir George Livesey; but in my research the name so continually cropped up during the last forty or fifty years of the gas industry, that I was compelled to insert it as frequently as I did. The only compunction I have is in having done so little justice to one who by his intelligence, foresight, tact, and determination, has done so much to raise the industry to its present proud position, and whose name will rank with that of Clegg the great gas engineer of the first forty or fifty years of gas manufacture, who by his inventive faculty and indomitable courage lifted the industry from the rut in which it found itself in those early days.

Aug. 22, 1907. The Writer of the "History."

PARLIAMENTARY INTELLIGENCE.

Water-Works in Rural Districts in Ireland.

The expenses attending the construction of water-works in rural districts in Ireland were the subject of a question put to the Chief Secretary for Ireland last Friday by Mr. Boland, the Member for South Kerry. He asked the right honourable gentleman whether he was aware that the Local Government Board had charged the electoral division with the expense of the Portmagee Water-Works, while in the case of the Cahirciveen works, in the same District Council area, the charge had been made a Union charge; whether he could explain why, in the case of Portmagee, the money was payable in 20 years at 7 per cent., whereas in the case of Cahirciveen it was payable in 50 years at 3¾ per cent.; and whether, seeing that the Rural District Council had applied for an extension of time, from 20 to 50 years, for repayment as regards the Portmagee scheme, he would see that equal treatment was given to the two schemes. In reply, Mr. Birrell said the Local Government Board had made orders fixing the district electoral division as the area of charge for the Portmagee works, and the rural district as the area of charge for the Cahirciveen works. In the former case, the Rural Council would only agree to the district electoral division as the area of charge; and the resolution of the Council requesting the Board to fix this area was proposed by the councillor representing the electoral division. A large proportion of the expenditure had been guaranteed from outside sources, and, as the amount falling on the rates would not in consequence press unduly on the ratepayers in the electoral division, the Board did not feel warranted in withholding their approval of the area desired by the Local Authority. In the Cahirciveen case, the area was fixed as the rural district, with the consent of the Rural District Council. The loan for the Portmagee Water-Works was repayable in 20 years, with interest at 3½ per cent. per annum; and the period for repayment for the Cahirciveen scheme was 30 years, and the interest 3¾ per cent. The periods in both cases were fixed by the Board after due consideration of the character and durability of the works. No application had been made to the Board for an extension of the period in the Portmagee case.

Prosecutions for the Prevention of Corruption.—In the House of Commons last Thursday, Mr. Lupton asked the Attorney-General in how many cases his consent had been sought for a prosecution under the Prevention of Corruption Act, 1906, and in how many he had given it. Sir John Lawson Walton, in a written reply, said there had been four applications, and fiats had been granted in three cases; the other being at present under consideration. Convictions had been obtained in all cases.

LOCAL AUTHORITIES AND WATER RIGHTS.

A Bill has been introduced by Mr. Leif Jones, the Member for Appleby, to empower local authorities to acquire water rights otherwise than by agreement. A memorandum prefacing the Bill sets forth that its object is to amend a defect which has been found to exist with regard to the taking of water. The Select Committee of the House of Commons on the Public Health Act (1875) Amendment Bill (1878) reported as follows:—

From the date of the passing of the Public Health Act up to last session of Parliament, it was believed that Provisional Orders could be obtained under the Act by which water rights could be compulsorily taken. Several Provisional Orders have been obtained under the belief that the compulsory taking of water rights by Provisional Order was legal under the meaning assigned to the word "lands"—this word being defined to include "messuages, buildings, lands, easements, and hereditaments of any tenure;" and it was thought that under the definition a local authority could purchase water rights compulsorily under the 176th section of the Act of 1875. During the last session of Parliament, a Committee of the House of Lords, when considering a Provisional Order for the compulsory purchase of water rights under that section by the Local Board of the West Houghton district, decided that the Order was *ultra vires*, and consequently it was not confirmed.

The Law Officers of the Crown were then consulted, and they advised: "We are of opinion that, in issuing a Provisional Order under the 176th section of the Public Health Act, 1875, the Local Government Board cannot confer upon a local authority power to purchase for the purposes of the Act and otherwise than by agreement any right to abstract water from any stream."

It follows from this that a Provisional Order which proposes to take water rights otherwise than by agreement cannot be made under the Public Health Act.

The Committee are of opinion that this decision will produce serious inconvenience to sanitary authorities; for it is apparent that, before water from a stream can be taken by a sanitary authority for the water supply of its district, an agreement would have to be made with every owner, lessee, and occupier below the proposed intake who may be affected by the abstraction of the water. The statement of the case is sufficient to show how difficult it would be to obtain the consent of those having these water rights. A sanitary authority could still obtain compulsory powers by a Private Bill; but it has been pointed out that the cost of obtaining a Private Bill is much higher than that of obtaining a Provisional Order.

The Committee therefore recommend that, with the view of affording to local authorities facilities for acquiring the right to take water from any stream, the Local Government Board should be empowered to issue Provisional Orders which, on confirmation by Parliament, would confer powers on the local authority for the purpose. The Committee are of opinion that the Provisional Order should incorporate the Water-Works Clauses Act, 1847, in the same manner as is usual in a Private Bill; but prior to the issue of the Provisional Order, the notices which in the case of a Private Bill would be necessary, under the Standing Orders of Parliament, should in all cases be published and served by the local authority.

This Bill carries out the above recommendations.

Clause 1 sets forth that for the purpose of enabling any local authority to supply water, there shall be incorporated with the Public Health Act, 1875, as amended by the proposed Act, the provisions of the Water-Works Clauses Act, 1847, with respect to the making of waterworks; and in the construction of such provisions the term "the Special Act" is to include the Public Health Act, 1875, as amended by the proposed Act, and any Order confirmed by Parliament authorizing a local authority to take, divert, collect, impound, or appropriate the waters of any stream otherwise than with the consent of the owners or occupiers of such stream, or the other parties, if any, interested in the same.

The second clause provides that, notwithstanding anything in the Public Health Act, 1875, to the contrary, any local authority, subject as subsequently provided, may, for the purpose of supplying any water-works which may have been constructed, or which may be proposed to be constructed, by them, take, divert, collect, impound, and appropriate such of the waters of any stream, whether within or beyond their district, as they may require for the purposes of water supply.

It is specified by clause 3 that the local authority, before interfering with the waters of any stream under the foregoing powers, otherwise than with the consent of the owners and occupiers, and of the persons, if any, whose consent under the Public Health Act, 1875, would be required, are to (1) publish once at least in each of three consecutive weeks in the month of November in some newspaper circulated in their district, an advertisement describing shortly the nature of the works which have been constructed, or which it is proposed to construct, naming a place where a plan of such works may be seen at all reasonable hours, and stating the name by which the stream is known at the point at which the water will be taken, the name of the parish in which such point is situate, and the quantity of the water which it is proposed to take; and (2) also to serve a notice containing the like particulars, in the month of December, on every owner or reputed owner, lessee or reputed lessee, and occupier of the mills, manufactories, and other works using the waters of the stream for a distance of 20 miles below the point at which the waters are intended to be taken.

On compliance with the foregoing provisions, the local authority, under clause 4, may present to the Local Government Board a petition under their seal, describing the nature of the works which have been constructed, or which it is proposed to construct, and shall state the name by which the stream is known at the point at which it is intended to take the waters, the parish in which such point is situate, the quantity of the waters which it is proposed to take, and the names of such owners, lessees, and occupiers who have assented, dissented, or are neutral in respect of the taking of such waters, and who have returned no answer to the notice. The petition shall pray that the local authority may be authorized to take, divert, collect, impound, or appropriate such waters otherwise than with the consent of the owners, lessees, and occupiers of the stream and other persons (if any) interested in the same; and the prayer is to be supported by such evidence as the Board may require.

On the receipt of the petition, and on due proof of the proper advertisements and notices having been published and served, the Local Government Board are to take the petition into consideration, and may either dismiss it or direct a local inquiry to be held. After the completion of the inquiry, the Board may, by Provisional Order, empower the local authority to take, divert, collect, impound, and appropriate the waters referred to in the petition, or any of them, otherwise than with the consent of the owners, lessees, and occupiers of the stream, and of the other persons (if any) interested in the same, and either absolutely or with such conditions and modifications as the Board may think fit; and the local authority are to serve a copy of any Order so made in the manner in which, and on the persons and on whom, the notices already referred to are required to be served.

The proposed Act may be cited as the Public Health Act (1875) Amendment (Water Rights) Act, 1907; and it is to be read as one with the first-named Act.

A New Standing Order.

The Standing Orders of the House of Commons have just been amended by the addition of the following Order (No. 36A) relating to the estimate of expenditure in case of works to be executed by a local authority: "On or before the 31st day of December, copies of the estimates of expenditure for any permanent works proposed to be executed by any municipal corporation, district council, joint board, or joint committee, or other local authority in England or Wales, shall be deposited at the Office of the Clerk of the Parliaments, and at the Office of the Board of Trade, or of the Local Government Board, as the case may require. The estimates shall be in the following form, or as near thereto as circumstances may permit:—

Estimate for Permanent Works.

	£ s. d.
Purchase of land and easements	
Buildings (specifying generally their nature)	
Reservoirs, filter-beds, &c..	
Tunnels, embankments, dams, &c.	
Trunk mains and main sewers	
Other mains, pipes, sewers, and sewage disposal works	
Other works grouped with regard to the probable life of the works	

If any moneys are required to be borrowed in excess of expenditure previously authorized by Parliament, the Board of Trade, or the Local Government Board, there shall be deposited with the estimates a statement of the purposes and reasons for the borrowing. Together with the estimates, there shall be deposited a statement showing the following particulars with respect to the district of the local authority, that is to say: (*a*) Area of district; (*b*) population according to the last census; (*c*) rateable and assessable value according to the last valuation list; (*d*) rates made in district during the last preceding financial year; (*e*) sum of balances of outstanding loans contracted by local authority; and (*f*) amount of outstanding loans to which the limitation of section 234 of the Public Health Act, 1875, applies."

LEGAL INTELLIGENCE.

A NEW GASHOLDER FOR ELGIN.

The Question of Dispensing with Consents.

On Tuesday last, Sheriff Wilson, K.C., held an inquiry in Elgin into an application by the Town Council of Elgin for an order dispensing with the consents of inhabitants within 300 yards of a site upon which the Council propose to erect a gasholder. The maximum daily consumption of gas during the past winter was 200,000 cubic feet; while the gasholder capacity is only 80,000 cubic feet. The Council, upon a report by Mr. J. Kay, the Gas Manager, resolved upon the erection of a new holder to give capacity equal to the maximum daily output. Three sites were considered—one upon Lossie Green, contiguous to the gas-works; another at the Pans, where the sewage-works are situated; and the third at the North Lane, in the centre of the town, where the Council own land sufficient for the purpose. The Council decided upon the North Lane site; but objections to it were lodged by owners and occupiers of properties adjoining.

Mr. HUGH STEWART, the Town Clerk, represented the Council; and Mr. D. JAMESON appeared for the objectors.

Mr. *A. A. Turriff*, the Burgh Surveyor, said that the proposed gasholder would only be seen from the upper back windows of the houses of the objectors. The site was 115 yards from the gas-works; and the houses of the objectors were from 80 to 120 yards distant. He considered that the holder would not be the cause of depreciation of properties.

The TOWN CLERK said it was found that the gasholder could not be built in the Public Park or the Cooper Park, because they were given for public amusement. Lady Seafield refused to give them Lossie Green, because several of her feuars objected to its being put there. With regard to the field at the Pans, all the ground there was required for the sewage-works. The Town Council agreed, by 11 votes to 5, to erect the gas holder on the site proposed.

Mr. *J. Kay*, the Gas Manager, said he reported as far back as 1905 that a new holder was necessary; and he afterwards reported, in January, 1907, that such a thing was an absolute necessity. He would have preferred the site on Lossie Green, as it was close to the works and more convenient. The next best site was on the ground at Pans. There was sufficient ground for a holder there, but not for gas-works. There would be certain loss there by condensation; and his estimate of the extra expense was £1500, and the additional annual expense of carrying on the work at Pans would be about £80. There ought to be no smell about a gasholder; and if there were leakage, they would easily detect it. The proposed gasholder, when full, would rise 60 feet

above the ground. This was greater than the present holders, which were 34 feet high. The proposed holder would be kept filled in the winter afternoons for several hours, but not during the summer. It was not possible to erect the structure inside the present ground at the gas-works, even supposing his dwelling-house were knocked down. The consumption of gas was increasing yearly; and this ground might yet be required for extending the works.

In cross-examination, the witness said the pipe to the proposed site would not cost much over £100. He always rectified a leakage when it took place. There was a loss by leakage last year of over 6 million cubic feet. This did not take place at the gasholder, but in the main pipes. At the present time the leakage amounted to 17,000 cubic feet, on an average, per day.

Mr. *A. Yuill*, of Dundee, said there was no room at the present gas-works for a gasholder; all the spare room would be required for future extension of the works. He would prefer to erect the holder on Lossie Green for the simple reason of having it near the works. The difference in the expense at Lossie Green or at the proposed site would be immaterial. If the holder were erected at the Pans, which was about a mile distant, a much larger pipe would be required than if it were put at the back of the model lodging-house. The extra cost would amount to from 1½d. to 1⅝d. per 1000 cubic feet. He could see no serious objection to the holder being erected on the site proposed. If the water-seal were properly attended to there ought to be no smell. He did not consider there was any danger of explosion—the gas-works were situated about 120 yards from the proposed holder. All the complainers' houses were within 300 yards of the present gas-works.

Mr. *S. Milne*, of Aberdeen, considered the site proposed was suitable; but he would have preferred it on Lossie Green, as it would have been closer to the works. He did not consider the site at the Pans such a good one as that proposed, as it was farther from the works. He considered the capital expenditure would be about £2250 extra. This would add from 1½d. to 1⅝d. per 1000 cubic feet, which at present cost 3s. 9d. He would not consider a gasholder objectionable on the site proposed. Gasholders in towns did not appear in any way to affect the feuing; and he knew of some valuable houses being erected in their vicinity. He would have no hesitation in introducing a gasholder in the centre of a town if the gas-works were already there.

The SHERIFF: What would you think was the object of the Legislature in enacting that gasholders were not to be erected within 300 yards of dwelling-houses?

Witness: I do not know what could have been in their minds at the time.

Mr. *J. Wittel*, an architect, of Elgin, did not think that the erection of the holder would depreciate the value of property in the immediate neighbourhood.

Mr. *A. Ramsay*, of Longmorn, said he was one of the largest ratepayers in the town of Elgin. He considered that the erection of the proposed gasholder would depreciate the value of his property. On the lower part of his ground, he proposed building a good class of workmen's houses; and he considered it would depreciate these, and also his his property in High Street. He had been 17 years in the Council, and was also a Magistrate for several years. When he built his property he did not anticipate that they would propose to put up this gasholder, and, as a ratepayer, he objected. From a public point of view, he did not think it was a proper course to distribute the gas-works over the town. He and others lodged a respectful petition to the Council. It was signed by leading men. They never were consulted. They were rather hurt at receiving no answer to their petition.

Cross-examined: If the gasholder were put up there, the chances were that the gas-works would always be kept in the centre of the town. It would appreciate the value and amenity of the locality if the gas-works were wholly removed.

Dr. *Alexander*, of North View, North Street, said he would see the proposed gasholder from several of his windows; and he considered that it would very much depreciate the value of his property. He did not believe in gas-works being built in the centre of a town. There was considerable danger to health, he understood, from leakage. Gas-works were considered public nuisances.

Dr. *J. W. Norris Mackay* said his property would overlook the proposed gasholder. He most certainly regarded this step of the Council as a retrograde one. He scarcely saw the gas-works from his drawing-room; but this holder would be in front, and would be an eyesore. He considered it would militate against all improvements in that vicinity, and would generally depreciate the value and the amenity of his property. It would also prevent him building houses.

Mr. *Charles C. Doig*, of Elgin, considered that the best site would be Lossie Green. He remembered that when the last gasholder was erected, about one-fifth of an acre was taken off Lossie Green. There was still ground there, if it could be obtained. As an alternative, he would suggest that they take down the Gas Manager's house and erect a holder of 160,000 feet capacity. There would still be room for an extension of the works. He considered the erection of the gasholder would depreciate the value of the property in the vicinity. At a distance of 110 yards, 43 feet of the gasholder would be visible from the bay window of Dr. Alexander's house; and from Dr. Mackay's drawing-room window, 43 feet. From the upper storey windows almost the whole of the gasholder would be visible. In the vicinity there were workmen's dwellings, and it would depreciate their value.

Sheriff WILSON said he would delay giving his decision for a fortnight, with a view to allowing the parties an opportunity of coming to an amicable arrangement, the possibilty of which had been mentioned in the course of the evidence.

Richmond (Surrey) Water Supply.—Under the Metropolis Water Act, 1902, the Richmond Corporation acquired the plant of the Southwark and Vauxhall Water Company employed to supply the district, and became the sole water authority. The total outlay on this plant and the works previously carried out by the Corporation has been £146,567; but the net outstanding indebtedness is only £63,000. The trading profit, over a period of fifteen years, has averaged £5544 per annum; and the aggregate net result of the Corporation's work as suppliers of water is a surplus of £3650.

MISCELLANEOUS NEWS.

LIVERPOOL UNITED GASLIGHT COMPANY.

The Half-Yearly General Meeting of this Company was held last Tuesday—Mr. H. WADE DEACON in the chair.

The Directors presented a statement of accounts covering the twelve months ending the 30th of June, and pointed out in their report that the total revenue was £619,020, and the expenditure £506,951; leaving a surplus of £112,069, which had been transferred to the profit and loss account. After deducting the amount taken for payment of the dividend declared in February, and the interest on the debenture stock, there remained a balance of £59,269, out of which they recommended that a dividend be declared for the past half year of 5 per cent. on the ordinary consolidated "A" stock, and 3½ per cent. on the 7 per cent. "B" stock created and issued under the Company's Acts of 1865, 1882, and 1886.

The CHAIRMAN, in moving the adoption of the report and accounts, said he had the good fortune to again congratulate the shareholders on a very successful year; the total consumption of gas having increased by 2¼ per cent. There was no change in the statement of stock and share capital or of loan capital; but on the capital account the small amount of £155 had been written off, owing to the fact that a large number of meters had been condemned as unfit for further use and had been destroyed. Turning to the revenue account, the total cost under the heading of "Manufacture of gas" for the year was £389,780, against £373,756 for the year 1906—an increase of £16,024. This was due to two causes. In the first place, more gas had been made, and therefore more material had been consumed; and, secondly, the price of coal was higher than the previous year. The wages at the works had decreased in consequence of the introduction of labour-saving machinery. There was also a reduction of £1000 in the repairs account. The repairs were, however, still very high, amounting to £70,000. But this figure included £15,000 for work in progress. Another reason why the repairs were high was, as he had explained at previous meetings, that the Directors had adopted a deliberate policy of spending a large amount for renewal purposes and for improving the works generally. This policy they proposed to continue; and he had no doubt they would see greater benefits from it than they had already received. There were certain things that were beyond their control; for instance, the price of coal. Still, they had bought as cheaply as possible; and, so far as he was aware, they had bought as advantageously as the majority of their neighbours. Therefore he did not think they had anything to regret on this score. With regard to the distribution of gas, the cost was rather higher this year than last because of the large number of meters which had been destroyed. Rates and taxes were apparently lower; but this was apparent rather than real, because some of the matters were still outstanding, and he was afraid it was too much to hope that they would get their rates and taxes permanently reduced. There was a new item in the accounts this year consequent on the Compensation Act. The Directors had considered the matter very carefully, and had decided that it would be a right and proper thing for the Company to take the risk themselves and prepare against it. They had accordingly put aside £1000 to form the nucleus of a compensation fund; and they proposed to increase the fund from year to year. The total expenditure on revenue account was £506,951; but on the other side of the account there were satisfactory increases. The price of gas was the same as before—2s. 6d. per 1000 cubic feet, which was the cheapest price at which it had ever been sold in Liverpool; but the receipts from the sale of gas had increased by £12,835, which was very satisfactory. He was glad to report that this increase had occurred among all classes of consumers. With residuals, they had done very much better; coke having brought in £8000 more, and tar £4000 more than in the previous year. With ammoniacal liquor, however, they had not done quite so well, having received £670 less on this item. The total receipts were £619,020; and there was a balance of £112,068 to carry to profit and loss account. They had to put to this the balance of £65,975 brought forward, which made a total of £178,043. From this had to be deducted interest on debentures and other interests, and they had a balance of £59,269 to go to next year's account, subject to the half-year's dividends. After paying these, there would be £6000 to carry forward. With regard to the future, the Directors had given to it a great deal of consideration. They estimated that they would have to pay next year something like £30,000 more for coal; and this, by itself, was equal to an increase of about 2d. per 1000 cubic feet of gas. The price had been 2s. 6d. for the last two years; and the Directors, being extremely loth to increase it without being absolutely compelled, had, after careful consideration, decided to wait for a time, and see how things progressed.

Sir EDWARD LAWRENCE seconded the motion.

Alderman STOLTERFOHT inquired whether the Directors had taken any steps with regard to the production of "Coalite."

The CHAIRMAN said the matter had been considered by the Directors, and at present they did not think it at all likely that anything would result. They would, however, watch the matter.

The report and accounts were then adopted.

On the motion of the CHAIRMAN, seconded by Sir E. LAWRENCE, the dividends recommended by the Directors were declared.

The retiring Directors and Auditor were re-elected; and the proceedings closed with a vote of thanks to the Chairman.

BOURNEMOUTH GAS AND WATER COMPANY, LIMITED.

Increased Gas Consumption—No Advance in Price—Assessment Dispute—Gas for Water Heating—Gas for Power on the Works.

The Ordinary General Meeting of this Company was held last Friday, at the London Offices, No. 90, Cannon Street, E.C.—Mr. G. CRISPE WHITELEY in the chair.

The SECRETARY (Mr. William Cash) read the notice calling the meeting; and the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving their adoption, said that reading the accounts of the half-yearly meetings of other gas companies, and the somewhat lugubrious remarks of some of the Chairmen, and noting the cases in which the price of gas had had to be increased, he had been bracing himself up for a somewhat more serious effort than it was usually his pleasure to address to the proprietors at their half-yearly meetings. Having felt that possibly he might have a more serious tale to tell, the proprietors could imagine it was with peculiar pleasure that, in spite of surrounding circumstances, he was able to lay before them a statement of accounts and condition of affairs which was quite as satisfactory as, if not more so than, those of past half years. There were good increases under every head. They were proposing to pay what he was pleased to call their usual dividends; and the Directors were, in accordance with their policy, writing down at the rate of £6000 a year the amounts spent in replacing the old gas-works by the new ones at Poole. And yet they had an increased carry-over. So far so good. He was not sure, looking into the future, that they might not want all these good things. The past half year had not, on the whole, been a flourishing one for gas companies. As a rule, the weather had been everything they did not want, and had affected more particularly seaside resorts like Bournemouth, where the very miserable cold spring and the very doubtful summer prevented the influx of visitors that had been anticipated. Under such circumstances, to be able to report an increase of output of 5½ per cent., and to do this when the consumption had practically doubled in Bournemouth in seven years, he thought presented a satisfactory state of affairs on which they might congratulate themselves. In regard to the water undertaking, the proprietors would be pleased to hear that their new softening plant was now in good order. They would remember the circumstances under which they had to carry out this work; and he hoped that those who wanted soft water were contented and satisfied. The Engineer was now trying to effect certain economies, so as to enable the softening of the water in future to be accomplished at a cheaper rate than in the past. He had spoken a good deal of their new Poole Gas-Works during the last few half years. The preliminary difficulties (which must always occur in large undertakings of the kind) were now at an end; and he was able to report that the works were in absolutely full working order. He could now say they had some excellent works in a good position. They were near both the harbour and the railway, and were therefore in an essentially convenient spot for their work. The proprietors might note one result of the new works in the amount of the wages account. A pleasant incident of the past half year had been the visit of the Southern District Association of Gas Engineers to Bournemouth and to the Poole works. This was due to their Engineer and General Manager (Mr. H. W. Woodall) being the President for the year. Representing the proprietors, the Board welcomed these representatives of the gas industry at Bournemouth, and showed them everything that was to be seen in their gas-works. The visitors carefully inspected the vertical retorts. He was not sure of the nature of all the comments and the results of the inspection; but of this he was certain, that the visitors spent a happy and thoroughly enjoyable day, and he hoped they benefited by seeing the new Poole works. Perhaps he might be pardoned if he mentioned a personal matter. The members of the old South-West of England Association of Gas Managers visited Bournemouth 23 years ago. On that occasion, the visitors were welcomed by his father, who occupied the position then that he (the Chairman) had the honour of representing and occupying on the occasion of the recent visit of the Southern Association. These were pleasant reminiscences for any man; and when he noticed the progress of the Company in the meantime, he thought that the proprietors were to be congratulated. Well, they had now to look to the future. As the proprietors knew, an increase in the price of coal was staring the Company in the face; and the possibility of having to raise the price of gas was before them. But the Directors were hoping—seeing that although they had an advanced price for coal, they had also fortunately a rise in the price of coke, with the increased sale of gas for cooking and heating which they trusted the increased cost of fuel would bring about, and with the larger carry forward—they might be able to breathe for the next twelve months without any immediate prospect of increasing the price of gas. Beyond that, it was impossible to say anything. Sufficient for the twelve months must be the good thereof; and whatever might happen after that, he would only hope they might be able to rise to the occasion. Of this the proprietors might be certain—the Directors would not raise the price of gas if they could possibly help it. It was a curious thing that, instead of raising the price of gas, they were going to reduce it; and in this respect they would be almost unique among gas companies at the present time. Under the Company's Act, it was their duty to reduce the price of gas at Poole by 2d.; and this they were able to do. He hoped their consumers at Poole would take full advantage of the cheap gas, and would remember that, though coal had gone up, gas in Poole at all events would come down. There was one little drawback he ought to mention. It had always been his pride, being a member of the legal profession, to keep down the Company's legal expenses. Unfortunately, they were now in for a fight. He thought it only right to announce that the Company would have to contest the assessments that had been made on their property by the local authorities. The Directors had carefully considered the matter; and they felt bound, in the interests of the proprietors and of the consumers of gas, not to accept the figures that had been suggested to them by the rating authorities. The Board were as anxious as anybody could be to avoid appealing to legal arbitrament; but the figures were so high, and the Company's own figures differed so materially and considerably from those of the local authorities, that he was afraid they must appeal to the Courts, and fight out the question to the very end. The contest would be a friendly one—as friendly as any legal contest could well be. But, from the Company's standpoint, it would be a very firm one, because they believed they were in the right. There was one additional source of profit (he thought he might point out) for the future; and it was a very hopeful one—that was, the gas-heated hot-water systems. They were introducing them into Bournemouth, and introducing them with great success. More than 60 of the boilers had been installed; and they were giving great satisfaction. If they could get 60, there was no reason why they should not get 600, and no reason why some day they should not get 6000. When one looked back, and remembered it was only some fifteen or twenty years ago since gas cookers and fires were freely introduced, it would be recognized that, if they could get gas-heated water-boilers introduced and developed in use at anything like the same rate, there was a wonderful future for this branch of utilizing gas. Though it was in comparatively recent years that gas-cookers had come on, they had now in Bournemouth no less than 14,000 of them; and if among an approximate total of householders of 18,500 they could get 14,000 cookers fixed, he hoped they would be able to increase considerably the number of gas-boilers which had been so successfully started and introduced during the half year.

Alderman S. L. RYMER, J.P., seconded the motion, remarking that the Company was never in a more prosperous condition than now.

Mr. GLEN asked whether the Directors contemplated investing any more of the large reserves they already had outside the Company. There was also the point as to the considerable depreciation the reserve fund investments had suffered recently. If their investments had been sold the previous day, there would have been a loss of about £2000. When the Company were in such a prosperous condition, was it not the opportunity for writing these down? A gratifying point to which reference had not been made was the extraordinary difference in the decrease of gas which was unaccounted for; and it would be interesting to know if there was any special reason for the tremendous saving in gas which had resulted in the past six months.

The CHAIRMAN said, with regard to the reserve fund, they were satisfied to keep it at £50,000, with its automatic increase by dividends at the rate of something like £700 a year, which the Directors thought was at present sufficient to go on with, especially as they were writing-down at the rate of £6000 a year for the old works. As to the proportion of the reserve fund that was invested, it was smaller than they would like. But they had had such large charges for new gas-works, water-softening plant, new well, and so forth, that the Directors thought they could utilize the money better in the business than by making investments outside. Now that the time had come when there would be a suspension of these large expenditures, the Board would reconsider the reserve investments. He was glad to hear the depreciation of the investments was only £2000, and the question of writing them down should have the attention of the Board.

The ENGINEER (Mr. H. W. Woodall), replying to the question as to the reduced leakage account, said that the proprietors would always find in this, as in other gas companies, the leakage was always smaller in the summer half of the year than in the winter one. It was to a certain extent a question of meter-reading. There was a bigger consumption going on at the time of meter-reading in the winter half, and the leakage was effected. The leakage was brought down in the summer half by, as a rule, nearly 1 per cent., but not nearly to the extent it appeared to be down this half year. If they averaged the two half years, however, it would be found to be at about 5 per cent.

The motion was unanimously carried.

Mr. R. HESKETH JONES moved the declaration of dividends at the rates per annum of 14 per cent. on the original shares, 7 per cent. on the "B" shares, and 6 per cent. on the preference shares—all less income-tax. He remarked that, though the dividend appeared to be high, commencing with 14 per cent., still on the average it was only 5⅝ per cent. on the capital actually subscribed by the proprietors. Personally, he was not quite so sanguine as the Chairman as to the avoidance of an increase in the price of gas for twelve months; and he hoped his remarks would not be construed into a pledge. Their reserve fund was not so very large to meet the extraordinary increase in the price of coal, which was equal to no less than 4d. per 1000 cubic feet. He had had experience with a water-circulating gas-boiler, and found it very effectual and convenient.

Mr. ERNEST L. BURTON, in seconding, emphasized what Mr. Jones had said as to the low *pro ratâ* dividend that was paid. The Company were singularly fortunate in having such a low basis of dividend. This resulted from the amount of premium capital, which stood at no less than £160,653 on the shares.

The motion was unanimously carried.

Proposed by Mr. BURTON and seconded by Mr. GLEN, a hearty vote of thanks was passed to the Chairman and Directors and officers.

The CHAIRMAN responded for himself and his colleagues; and then referred to the appreciation of the Board of the efforts put forth by their executive officers, the staff, and the workmen.

Mr. CASH, having acknowledged the vote, referred to a somewhat novel feature in the accounts. The motive power, he said, used at Poole was electricity generated by gas-engines; and, in consequence, a large quantity of gas was consumed on the works compared with the usual allowance of 1 per cent. Therefore special entries had been made in the accounts for this. This was a practice he hoped other gas companies would follow where gas was used largely for power on the works. He also referred to a visit the Lighting Committee of the Corporation paid to the Poole works, and in conjunction with which the Town Clerk had written thanking the Company for the courtesy shown them. He (Mr. Cash) thought he might say the visit of the Committee confirmed their impression that the Company were doing their best in the interests of Bournemouth.

Mr. WOODALL also responded for himself, his staff, and the workmen; and the proceedings then terminated.

PROVINCIAL GAS COMPANIES.

Meeting the Increased Cost of Coal at Barnsley.

At the annual meeting of the Barnsley Gas Company on Monday last week, the accounts presented showed a balance of £5144 available for distribution; and the Directors recommended that, in addition to the interim dividend paid on the 1st of March last, a further dividend should be paid of 5 per cent. on the general capital stock and "F" shares, 3 per cent. on the "C" (preference) shares, and 3½ per cent. on the "D," "E," and "G" shares, less income-tax in each case. In moving the adoption of the report, the Chairman (Mr. E. G. Lancaster, J.P.) stated that the cost of manufacture of gas had increased by £714, of which £620 was owing to the rise in the price of coal; £1267 had been saved on distribution—accounted for by the fact that the repairs had been light. On the total expenditure there was a

decrease of £735. On the other side, the most satisfactory feature was the increase of 4 million cubic feet of gas sold; and, exclusive of the public lighting, there was an increase of £567. Unfortunately, this was reduced by the lower value of the residual products; leaving only £2000 increase. Altogether, he considered the figures were satisfactory; but the coming year was causing some anxiety. The Directors had accepted their coal tenders, and they knew they were going to have to pay £2000 extra for coal. It was the sudden increases in the price of coal that made it difficult work for gas companies to arrange their figures so as to be satisfactory to both sides. He had a list of 34 gas companies who had increased their price from 2d. to 9d. per 1000 cubic feet, owing to the higher coal bills, The Directors did not propose to raise their price; but they would have to temporarily suspend the sliding-scale of discounts. He looked upon the discount system as being rather an advantage, in that, should times require it, if the price of coal went up, the scale must come down, and if coal went down the scale would go up. Therefore he considered it was fair for both sides. The motion was carried.

A Favourable Report from Cork.

At the half-yearly meeting of the Cork Gas Consumers' Company on Friday, the Directors reported that the accounts for the six months ending the 30th of June showed a small decrease in the rental compared with the first half of 1906; but it was confined to the March quarter, and was principally on the consumption for gas-fires, owing to the unusually mild weather which prevailed. The returns from residuals had increased; and this compensated for the diminished rental. The total revenue for the half year was £26,553, and the expenditure £19,193; leaving a balance of £7360. The balance on the profit and loss account, after placing £302 to the depreciation fund, was £5955, out of which the Directors proposed to pay a dividend at the rate of 8 per cent. per annum. This would absorb £5555, and leave £400 to be added to the reserve fund. In a report appended by Mr. R. Bruce Anderson, he mentioned that all the gas was now being made by the new gaseous settings erected by Messrs. Gibbons, which were working economically. In moving the adoption of the Directors' report, the Chairman (Mr. George Lynch) remarked that, notwithstanding the very severe competition the Company had had to contend with, the number of the customers continued to increase, and they had now in use altogether 7999 meters, prepayment and ordinary. For some months past they had been making their entire supply of gas in the new retort-house with the settings referred to by Mr. Anderson; and though the cost of labour was higher, the increased production of gas compensated for this, and the results were satisfactory under present conditions. In most other cases where these settings were in use the charging and drawing of the retorts and the handling of the coal and coke were done by machinery. This, however, the Directors had no desire to employ, so long as the work was done by hand labour on reasonable terms. He was sorry to say there had been a large advance in the price of coal. After delaying for some months in the hope that it might be only temporary, the Directors had to follow the example of the large English gas companies, and contract for their winter supply at much more than they paid last year. There seemed to be no sufficient reason for so great an advance; and they hoped that before the next meeting there would be some prospect of a return to lower prices. Mr. Mahoney seconded the motion, and it was carried.

An Extended Area at Maidstone.

Under the Act obtained by the Maidstone Gas Company in the present session, their area of supply was extended by the inclusion of several parishes; and, in exercise of the powers conferred upon them, they have agreed to purchase the undertaking of the Sutton Valence Gas Company on the 1st of October next, and connecting mains are now being laid between Leeds and Sutton Valence. Recent extensions to rural parishes continue to show favourable results; but, owing to the large increase in the cost of coal, the Directors have felt it right to raise the price of gas from 2s. 4d. to 2s. 6d. per 1000 cubic feet, as from Midsummer, 1907. The business in the year ended June 30 increased satisfactorily; and the accounts for this period, which were presented at the recent annual meeting, showed a sum of £13,209 available for distribution. Out of this, the Directors recommended the payment of a dividend (less income-tax) of £3 16s. 3d. per cent.; making with the interim dividend £7 12s. 6d. for the year. In moving the adoption of the Directors' report, the Chairman (Mr. George Marsham) referred to the outstanding feature of the year's work—the enlargement of the area of supply. He said the supply obtained from the villages which were already furnished with gas, though in some of them the business was not yet fully developed, quite came up to the estimate; and the Directors had every reason to believe that the new districts would be equally satisfactory. The steady growth of the business of the Company would be best gathered from the figures he would quote. The length of mains now supplied was 63½ miles; being a growth of 3½ miles during the year. The gas sold showed an increase of 6½ million cubic feet, or 2¼ per cent. Of this increase, 5 million cubic feet had been obtained from the extensions made since 1903 to the surrounding villages; and the remainder showed that the Company more than held their own in the borough. The sum received for gas had increased by £939; and that for the hire of meters, stoves, and fittings by £285. The receipts for residuals, owing principally to the low price obtained for tar, had decreased by £241. The number of consumers had augmented by 432 during the year; the total number being 3464 ordinary, and 5607 prepayment. The number of cooking-stoves on hire was 6001, and of heating-stoves 1212—being increases of 307 and 65 respectively; and the Company's workmen now maintained 5174 incandescent burners. An important addition which the Directors were now introducing in the works was an oil-gas plant. This would, it was believed, result in economy in the production of gas, and would ensure a sufficient supply throughout the extended area during the winter months. The Directors had always taken some pride in the fact that the price of gas had been for many years the lowest in Kent outside the Metropolitan area; and though they had had to advance it 2d. per 1000 cubic feet as from Midsummer last, owing to the largely increased cost of coal, they believed this small addition still left it as cheap as it was in any other Kentish town. In conclusion, the Chairman referred to the satisfaction the staff and employees had again given the Directors. Dr. Hoar, in seconding the motion, expressed the opinion that the extensions would eventually be of great benefit to the shareholders. The report was adopted.

An Excellent Half Year at Normanton.

In the report which the Directors of the Normanton Gas Company submitted at the recent half-yearly meeting, they stated that the profits for the six months ending the 30th of June amounted to £1809, and that there was a sum of £3443 available for distribution. They therefore recommended dividends of 5½ per cent. on the original, and 4 per cent. on the additional stock. In moving the adoption of the report, the Chairman (Mr. E. Mitchell, J.P., of Ossett) said the consumption of gas during the half year showed an increase of more than 5 per cent., and the working had been successful in every way. One most satisfactory feature was a reduction in the leakage; and the Directors hoped to be able to improve on this in the future. They had now to face the high price of coal; the new contracts having been made at a largely-increased figure. They hoped, however, by the improvements in the works which had been made from time to time, and a saving in leakage, that it would enable them to meet the present advance without having to raise the price of gas, which the Board would be most reluctant to do. Having referred to the principal items of expenditure, the Chairman said the total was £2957. The income from gas was £255 more, and from residuals £28 more, than a year ago. The total income was £4766; being an increase of £284. The fund available for dividend was, he thought, the largest they had had for some years. They had had an excellent half year. The report was adopted.

An All-Round Increase at Portsmouth.

The half-yearly general meeting of the Portsea Island Gas Company was held last Saturday, under the presidency of Alderman Sir John Baker, M.P., J.P. In their report, the Directors stated that, exclusive of the amount standing to the credit of the extraordinary renewals account (£9200), the profit and loss account showed an available balance of £44,040, out of which the payment of dividends at the following rates was recommended: 13 per cent. on the "A" and "B" shares, 12 per cent. on the "C" shares, 10 per cent. on the "D" and "E" shares, and 5 per cent. on the stock (all less income-tax); leaving a balance of £26,108 to be carried forward. The Directors added that both the number of consumers and the quantity of gas sold continued to increase; and that the efficiency of the manufacturing and distributing plant had been fully maintained. The accounts accompanying the report showed that the revenue for the half year ending the 30th of June amounted to £108,023, compared with £99,919 in the corresponding period of last year; and the expenditure was £88,875, against £81,006. The balance carried to the profit and loss account was consequently £19,148, as compared with £18,513. In the manufacture of gas during the half year, 55,532 tons of coal and cannel were used, together with 385,507 gallons of oil. The gas made amounted to 649,940,000 cubic feet, compared with 627,720,000 cubic feet before; the quantity accounted for, to 622,364,800 feet, against 599,729,100 cubic feet in the first half of 1906. The total of the reserve fund was £54,751, and of the insurance fund £16,865. In proposing the adoption of the report, the Chairman said that under every head there had been an increase, and the Company were now realizing the benefits which their new works had prospectively given them long ago, thanks to the skill and energy of their Engineer and General Manager (Mr. J. D. Ashworth), who never lost an opportunity of adapting improvements. The Company had recently fitted the Southsea Clarence Pier with gas, which had given satisfaction to everybody; and they had during the half year increased their consumers in the borough by 1980. Mr. R. E. Hellyer seconded the motion. In the subsequent discussion, a shareholder suggested that much satisfaction would be given if the rental of meters were abolished, seeing that the Borough Electric Light Committee had devoted £900 per annum for a similar purpose to the users of the electric light. Alderman Power said the consumers of electricity and of gas were on very different footings—the former being liable for a minimum consumption of 7s. 6d.; and the Chairman spoke of the economy of gas as compared with the electric light, in connection with which he mentioned that by the newly-introduced gas methods he had superseded the electric light in his own Brighton establishment—the cost now being only one-third of that formerly borne by his firm. The motion was carried.

Dearer Coal Causes Higher Price at Sutton.

The Sutton Gas Company have declared a dividend of 6 per cent. for the past half year; but as dearer coal has caused an increase of 2d. per 1000 cubic feet in the price of gas, the dividend will, by the operation of the sliding-scale, be reduced in future. Among the receipts for the six months were £11,715 from the supply of gas, and £4217 from the sale of residuals. The expenditure was £13,933; and the profit of £3468 brought up to £12,896 the balance on the profit and loss account.

Increased Sale of Gas at Wakefield.

Dr. W. A. Statter, the Chairman of the Wakefield Gas Company, presided at the ordinary half-yearly meeting on Monday last week, and in moving the adoption of the report said the working in the six months ending the 30th of June had been successful; the quantity of gas sold showing an increase of 5·27 per cent. The dividend required had been earned, and a good balance was carried to the next account. Despite the fact that the price of coal had much increased, the Directors hoped to be able to pull through without advancing the price of gas. Mr. G. A. Moorhouse (Vice-Chairman) seconded; and the motion was agreed to. The accounts accompanying the report showed that the revenue in the half year was £23,867, and the expenditure £15,698; leaving a balance of £8169 to go to the profit and loss account. The balance available for distribution was £11,389; and it was resolved to pay 4½ per cent. dividend on the preference stock, 5¾ per cent. on the £25 and £5 shares respectively, 4½ per cent. on the £5 "B 5th" shares, and 4¼ per cent. on the new ordinary £10 shares. The customary vote of thanks to the Chairman and Directors was passed unanimously. In responding, the Chairman moved, and the Vice-Chairman seconded, a vote of thanks to the Engineer and Manager (Mr. H. Townsend), the Secretary (Mr. W. H. Parker), and their respective staffs, which was cordially approved and suitably acknowledged.

GAS LIGHTING IN THE METROPOLIS.

[From the "Joint-Stock Companies' Journal," Aug. 21.]

Steadily as time goes on, the quantity of gas used for public and private purposes increases. The slot meter, incandescent mantle, and other devices which have done so much to place the industry on a broader and safer basis, have now been sufficiently long in use for their initial effects to have worn down to the normal; so that it can be seen, by a simple comparison of figures, that the enlarged consumption recorded in recent accounts is not the outcome of tapping new classes, but is the natural and satisfactory effect of growth of an ordinary, as contrasted with an extraordinary, kind. For the purposes of the present examination, we set side by side some of the principal points in the accounts of nine Companies, whose combined area is very great, and is worked and dwelt in by the people of London. They are the Brentford, Commercial, Croydon, Gaslight and Coke, South Metropolitan, South Suburban, Tottenham and Edmonton, and West Ham Companies; and the accounts dealt with are those covering the half year to June 30, 1907, and the corresponding divisions of 1905 and 1906.

In the half year ended June 30, 1905, these nine Companies sold 21,383,819,000 cubic feet of gas for lighting, heating, and cooking purposes to private consumers and for public uses; their revenue from all sources was £3,658,213, and their profit £889,282. In the first six months of the following year, the sales were 22,286,439,000 cubic feet, the revenue receipts were £3,787,119, and the profit was £976,996. In the past half year the output was 23,136,458,000 cubic feet, the revenue £4,070,460, and the profit £1,059,281. There is no need to insist upon the proof afforded by these figures that London is using more and more gas, giving the makers more and more profit. Going a little further into details, however, it becomes evident that it is not the gas consumer who has provided the whole of the increase of gross and net revenue. In the 1905 period, £2,732,592 of the total income took the form of actual payment for gas supplied, £133,161 was paid by way of rental of meters, stoves, &c., £765,444 was secured by the sale of residual products of manufacture, and there were other incidental receipts. In the next period referred to, only £4000 of the increase came from residuals—sales and rents providing the remainder; for gas was cheaper in one or two cases, and the sales were substantially greater. But in the first half of 1907, when the total income was enlarged by £283,000, as much as £123,000 of it fell under the head of residual sales; for as the price of coal advanced, so did the value of coke and other bye-products.

The average price realized for gas in the early part of 1905 was 2s. 6·6d. per 1000 cubic feet, including public lighting, after deducting discounts. To this the proceeds of the sale of residuals added 8·6d. per 1000 cubic feet, against which may be set, by way of contrast, the cost of raw materials for manufacture, which was 1s. 1·8d. per 1000 cubic feet. Other manufacturing charges amounted to 8d., distribution of gas and the care of public lamps cost 4·5d., rates and taxes (with an insignificant sum for rents) absorbed 2·6d., administration cost 1·9d., and the profit (10d.) makes up the total income, which was equal to 3s. 5·1d. per 1000 cubic feet of gas sold. The discrepancy of 0·3d. is explained by co-partnership payments by the Commercial, South Metropolitan, and South Suburban Companies. In 1906 the average figure realized for all the gas that was sold, whatever its purpose, was 2s. 6·7d., or a shade more than in the corresponding period; and as residuals were not so good, at 8·3d. per 1000 cubic feet sold, the total income works out at 3s. 4·8d., including sundries. This amount was dispersed as follows: Coal and oil, 1s. 1·5d.; other manufacturing charges, 7·7d.; distribution, &c., 4·5d.; rates and taxes, 2·5d.; administration, 1·8d.; profit, 10·5d.; payments under co-partnership schemes, 0·3d. It will be noted that raw materials for the manufacture of ordinary coal gas and carburetted water gas cost slightly less, measured by the sales, in the earlier part of 1906 than in 1905, and the profits were on a somewhat higher scale. When we come to examine the figures for the first half of 1907, however, we are faced by some rather striking contrasts. The total receipts were equal to 3s. 6·2d. per 1000 cubic feet of gas sold, the sales themselves producing 2s. 6·5d. and residuals 9·3d. That is to say, gas was cheaper, but residuals were a very much more valuable source of income than in either of the two corresponding periods. The advantage, however, was swallowed up in the advance of the cost of coal to 1s. 2·6d. per 1000 cubic feet sold; other manufacturing expenses were 7·2d. (a useful saving); distribution cost 5d., rates and taxes 2·4d., and administration 1·7d.—leaving a profit of 11d. (after deducting 0·3d. for profit-sharing), which makes the half year undeniably satisfactory in all respects. The greater cost of the coal and other materials, however, cannot fail to have a serious effect upon the results of the current half year. Until 1907 had well begun, coal was coming in under old contracts at relatively low rates; yet we see that the average payment for raw materials was 1d. per 1000 cubic feet in advance of the corresponding period. As the new contracts will apply to the whole of the half year now proceeding, we must be prepared for greatly enhanced working charges, the certainty of which has caused prices to be advanced to private users by the Companies which account for the great bulk of London's gas supply.

There is one item to which, in conclusion, special attention may be drawn; it is rates and taxes. It will be noted that about 2½d. per 1000 cubic feet which consumers pay ostensibly for gas actually passes to the coffers of public bodies in the shape of rates and taxes; that, in fact, upwards of 8 per cent. of the proceeds of gas sales are so absorbed. In other words, out of every sovereign paid by the consumer for his gas supply, something like 1s. 7¾d. is disguised taxation. And it really comes from the pocket of the consumer, not from that of the stockholder; for if it ceased, and gas were cheapened, the proprietor would benefit, but the sliding-scale will not allow him to receive more unless and until the consumer pays less. This indirect collection of rates (taxes, which we cannot separate, are different) is really bad, because the ratepayers never know what they are actually paying; and there is obviously a great deal in the plea of the South Metropolitan Company that the basis of assessment should be made plain, in justice not to gas investors alone, but to gas users—that is, to everyone.

THE INCREASED PRICE OF COAL.

As briefly recorded in our "Editorial Notes" last week, Mr. A. Fell, the Member for Yarmouth, called the attention of the Chancellor of the Exchequer, on Monday last week, to the statement of Sir George Livesey, at the meeting of the South Metropolitan Gas Company, to the effect that the abolition of the export duty of 1s. per ton had unduly raised the cost of coal, and had increased the foreign demand for it, to the detriment of the industries of this country, and he asked whether, having regard to the price of coal likely to prevail during the coming winter, and to the hardship this would entail, he would consider Sir George's suggestion to impose an export duty of 2s. a ton, so as to put some check on excessive export. Mr. Fenwick, the Labour Member for the Wansbeck Division of Northumberland, followed with another question—viz., whether Mr. Asquith was aware that the cost of coal at the pit mouth was only 8s. 5¾d. per ton, and that the excessive price which the consumer had to pay was due to the action of the middleman taking advantage of the excessively cold summer to keep up the winter prices throughout the season. Mr. Asquith said he was not able to answer the latter question without making inquiries; but he had no doubt the hon. member was accurate. In reply to Mr. Fell, he said his attention had been called to the statement referred to, but he did not concur in it; and he was not prepared to consider the reimposition of the duty, either at 2s. a ton or at any other rate. The reply was received with cheers.

"The Times" on Tuesday contained the following letter from Sir George Livesey on the subject of Mr. Fenwick's question: "Mr. Fenwick is reported in 'The Times' of to-day as saying 'that the cost of coal at the pit mouth was only 8s. 5¾d. per ton, and that the excessive price which the consumer had to pay was due to the action of the middleman taking advantage of the excessively cold summer to keep up the winter prices throughout the season.' This is an excessively weak excuse for the high price of coal, and can only be regarded as a 'terminological inexactitude,' or at least as very misleading. I do not know where Mr. Fenwick gets his very exact figure of 8s. 5¾d., but suppose it must be some past average, which certainly does not give the present position correctly; and it is unjust to the middleman. I do know that this Company [the South Metropolitan] in 1905 made contracts for over a million tons of Newcastle coal at 7s. 6d. a ton free on board in the Tyne; the price used to be about 6s. 6d. In 1906 we paid 8s. 6d.; and in April, 1907, the price was 11s. 6d. a ton. In 'The Times' Financial and Commercial Supplement of yesterday there is this statement dealing with Newcastle coal prices: 'Current quotations are: Best steams, 16s. 6d.; seconds, 15s. 6d.; smalls, 10s. to 10s. 6d.; best gas coal, 15s. 3d. to 15s. 6d.; seconds, 13s. 9d. to 14s.; Durham bunkers, 14s. 6d. to 15s.; coking coals, 14s. 6d.; households, 15s. to 17s. 6d.' Your figures for gas coal correspond with prices recently asked of us. All the above are f.o.b. prices, being direct dealings without the intervention of a middleman. There is a deduction to be made for carriage from the pit mouth to the ship; but, with that off, Mr. Fenwick's figure of 8s. 5¾d. is still inexplicable. I have been told that the North-Eastern Railway Company charge up to 1s. 6d. per ton; but where a colliery has its own railway the cost is less. Your reports from all the other coal districts show that the price has risen considerably in the last three or four months, and that further advances are expected. The fact is, there is an active home and a very active foreign demand for our coal, which (especially the latter) has enabled coal producers to raise prices excessively, to the detriment of all home industries and the domestic users of coal."

The member of a large wholesale firm stated in the course of conversation with a representative of the "Daily Telegraph" that the maintenance of the foreign demand for British coal and the impending rise in wages were alike responsible for the present situation. "Owing," he said, "to the inability of the Westphalian Syndicate to supply its own wants locally, Germany is buying very largely from us, not only in steam-raising coal, but in all the better-known household varieties." "Do you think," he was asked, "that the abolition of the export duty on coal is a factor in the present situation?" "I am inclined to think not," was his reply. "The fact is," he added, "that if there had been an export duty of even 5s. a ton, the Germans would have been compelled to take our coal just the same. You see what we might have been reaping from the foreigner." "And now about the prospects of the householder?" was another question. "Well," was the reply, "so long as this foreign demand continues, I do not see how low prices are ever to rule; and I really believe that before the winter is over we shall witness a return to the prices of 1900, when certain classes of coal sold at as high as 35s. a ton. You see that in connection with this matter of foreign exports we have not only to reckon with the requirements of European countries. We have to remember that as new countries are being opened up to railway communication, the demand from abroad will tend to increase, as ours is, roughly speaking, the only coal which these countries can obtain. The householder's chief hope lies in a slackening of the present German demand."

Speaking to a representative of the "Standard" last Tuesday, Mr. F. B. Cameron, of Messrs. Cameron and Co., expressed the opinion that the present state of affairs had been brought about mainly by the abolition of the tax upon exported coal, coupled with the great boom in trade upon the Continent. "It is a question now of getting coal from anywhere," said Mr. Cameron. "It all seems to have been bought up by foreign firms; and all our ports are congested with loads for Germany, France, Russia, and other countries. In fact, there are not ships enough to carry it away at once, and quantities are now lying at the docks waiting for shipment. The action of the railway companies in carrying only the exact weight of coal, instead of allowing for wastage as previously, and the institution of the eight-hour day, have also been important factors in bringing about the state of affairs which now exists; and, of course, the mineowners, no doubt, feel that they must protect themselves on account of the gradual rise in the wages of their employees. The increase in price affects every kind of coal, and I cannot say what it will reach in September, as it is a question of the quantity available. It is safe to say that coal will be dearer this year than, or, at any rate, as dear as, it was during the South African War."

ZURICH GAS SUPPLY.

Report of the Zurich Gas-Works for the Year 1906.

The report for last year of the Zürich gas undertaking, of which we have received a copy from Herr Weiss, the Engineer, is as interesting as the earlier annual reports of which summaries, such as the following, have appeared from year to year in the "JOURNAL."

The extension of the large gas-works at Schlieren, of which a description has already been given, proceeded during the year; but delays occurred, partly owing to the subsoil proving very bad for foundations in certain places, and partly owing to scarcity of hands. There have been completed the foundations for two benches of vertical retort-settings and for a chimney for them; and there are in hand an iron-work retort-house, a coal-store in iron and concrete, a gasholder of 50,000 cubic metres (1,765,000 cubic feet) capacity, and some smaller structures.

The gas made amounted to 23,344,700 cubic metres (824,442,000 cubic feet)—an increase of 9·45 per cent. on the make in 1905. There were carbonized 76,593 metric tons of coal and 964 metric tons of cannel; and the average make of gas per English ton was 10,801 cubic feet—about 25 cubic feet less than in the preceding year. There was again a slight decrease in the price paid per ton of coal. The average weight of the charge per retort was 392 lbs. Of the total make of gas, 55·29 per cent. was sold for heating and cooking purposes, 2·74 per cent. for power, 18·78 per cent. for lighting (private consumers only), and 9·61 per cent. for public lighting. These figures refer to the town district; 2·94 per cent. of the gas made being delivered to suburbs. The unaccounted-for gas amounted to 4·36 per cent. of the make. There was a slight falling off in the quantity of gas consumed for power purposes.

The following table shows the average yields of bye-products in 1906, stated in percentages of the weight of coal carbonized:—

Coke	73·3670	Producer clinker	3·6800
Ammonia	0·1975	Retort carbon	0·0930
Tar	6·3180	Prussian blue from sludge	0·0829
Thick tar (pitch)	0·3660	Naphthalene extracted by oil-washing	0·0313

The yields of coke and ammonia were appreciably higher than in the preceding year.

The number of burners in street-lamps increased from 7315 in 1905 to 7466 last year. The street lighting was almost wholly by incandescent burners—there being now only 50 of the flat-flame kind. The average number of mantles used per burner in the year was 4·96, and of chimneys 2·42. Besides the ordinary burners, there were 21 Lucas lamps and 6 "Millennium" lights. The price of gas for lighting purposes was reduced on Oct. 1 from 25 c. to 22½ c. per cubic metre (the price is about 5*s.* 1*d.* per 1000 cubic feet). Daily tests of the gas were made for calorific power, illuminating power, and sulphuretted hydrogen. The net calorific power of the gas averaged about 569 B.Th.U. per cubic foot at 60° Fahr. and 30 inches. The net profit on the year's working was 951,646·81 frs. (about £38,066).

AMERICAN VIEWS OF MUNICIPAL OWNERSHIP.

In the "JOURNAL" recently (*ante*, p. 436), reference was made to the investigation into the subject of municipal trading carried out by the Commission on Public Ownership and Operation of the American National Civic Federation, and to their reports thereon. Labour conditions and the character of the gas, water, and electric service rendered by public and private plants are covered by the official reviews which have been made public up to the present time. The Commission appointed a Committee of Investigation of 21 members, who engaged in turn a staff of engineers, accountants, and statisticians to examine thoroughly every undertaking in America and Great Britain visited by the Committee. These experts were so chosen that, in each examination made, both sides of the municipal ownership question were represented. Thus, one engineer, accountant, or statistician approached the subject under consideration favourably disposed towards municipalization, while his colleague began his task holding views in opposition to this principle. Our contemporary "Engineering Record" gives some extracts from the reports of the Committee; and we take therefrom the following particulars on matters of interest to our readers.

The labour conditions under private and public ownership are discussed by Professor John R. Commons, of the University of Wisconsin, and Mr. J. W. Sullivan, the Editor of the "Clothing Trades Bulletin." Starting with the same information gathered by the experts as a basis for argument, the former arrives at the conclusion that corruption under municipal control is no greater than under private ownership; while the latter makes caustic reference to political rottenness, which he declares to be evident in Syracuse, Allegheny, and Wheeling. According to Professor Commons, the investigations have shown that the strongest safeguard for a manager against the pressure of outside recommendations is the recognition of organized labour within its department. He says that wherever they found a class of employees organized and dealt with as such through their representatives, the positions were exempt from politics. He thinks this follows from the nature of labour organization, which cannot survive if individuals are given preference on political, religious, personal, or any other grounds than the character of the work they do. Even in the politically honeycombed municipal undertaking at Allegheny, the union of electrical workers stopped the practice of paying assessments by its members for political campaigns. The success of the civil system of Chicago is considered to be due more than anything else to the fact that organized labour has one of the three members on each examining Board. The Manager of the Manchester tramways ascribes his freedom from interference by individual councillors to his recognition of the Trade Union that contains 90 per cent. of his motor men and conductors. The minimum payment for common labour by the private companies in the United States, except in Atlanta, is lower than that of the cities investigated; and the hours of labour are longer. The labourers employed by the municipalities are in all cases citizens; but most private companies employ foreigners when coloured labour is not available.

Mr. Sullivan sums up his observations with the conclusion that in all but the most poorly paid forms of labour, and for tramway employees, municipalization has not raised the wages or improved the working conditions of the employees above those in the private undertakings. With respect to "common, unorganized labour," however, the investigators found a difference rather favourable to British municipal employees. The report cites two causes for this condition—first, that the municipal labourer is a picked man; and, secondly, that this class of labour is capable of exerting on city councils a combined pressure which obtains for them better terms than the employing councillors accord to the men they hire in their private capacity for similar work. Mr. Sullivan says no street car undertaking in Great Britain has ever been a "private" enterprise in the sense in which the word is applied in America. "The twenty-one years' term of the franchise, the veto of company petitions by village authorities, the enormous cost of parliamentary powers and local assents, and various other restrictions non-existent in the United States, shackle and impoverish British tramway company management, and consequently forbid an intelligent investigator employing British example to illustrate possibilities in America through change from private to municipal ownership. British tramways have always been semi-municipal. As by the terms of their franchises all English tramway undertakings may be taken over by the municipalities, the Directors manage their properties with this end in view. Compared with the remarkable changes for the better in wages and hours in the American street-car industry under companies, the best of the British municipal labour improvements seem hardly more than trivial."

The reports of the investigating staff for water and lighting plants have been reviewed by Vice-President Walton Clark, of the United Gas Improvement Company, President Charles L. Edgar, of the Edison Electric and Illuminating Company, of Boston, President Frank Parsons, of the National Public Ownership League, and Superintendent Edward W. Bemis, of the Cleveland Water-Works. The experts examined the public gas-works at Wheeling, Richmond, Holyoke, and Westfield, and the private gas plants at Atlanta, Norfolk, Philadelphia, and Fitchburg and Beverly; also the municipal water-works at Cleveland, Chicago, and Syracuse, and the private water-works at New Haven and Indianapolis; the public electric light and power plants at Chicago, Allegheny, South Norwalk, Detroit, and Danvers, Holyoke, Taunton, Chicopee and North Attleborough, and other places, and the private lighting plants at Northampton, Fitchburg, Salem, Beverly, Gardner, Abington, and Attleborough.

The Wheeling gas plant is severely criticized by Messrs. Clark and Edgar; while the plants at Norfolk and Atlanta are regarded as satisfactory. They say: "If we consider together the price the Wheeling consumer pays for gas and the character of the service rendered, we may not doubt that he gets less of net result per dollar expended than does the gas consumer in Atlanta or Norfolk. Low and varying pressure, uncertain candle power, influenced at times by a dash of natural gas (at Wheeling), will bring troubles to studying children that, while not factors in financial calculations, have a proper place in this inquiry. Wheeling's gas plant is not an important factor in the well-being of Wheeling's citizens. What with fast meters, charges for service and meter setting, absence of any gratuitous work, the admixture of 15 c. 8-candle power natural gas, insufficient and irregular pressure, and general inefficiency in the complaint department, Wheeling gas is a dear commodity at any price. Our experts found nothing to praise in Wheeling's service, and little to criticize in the service of the Companies at Norfolk and Atlanta."

Mr. Bemis, on the contrary, holds up the Wheeling plant as an example of what may be accomplished by a municipality, even under unfavourable political conditions. Despite its admitted defects, he says the Wheeling experiment has been a financial success, and has been "the pioneer throughout the United States in low charges." He does not agree with Mr. Edgar and Mr. Clark as to the value of the free installation by the private Companies at Atlanta and Norfolk, saying on this point: "The gas sold in Wheeling during the sixteen months ending May 1, 1905, was 162,515,200 cubic feet. The difference between the price charged at Wheeling, 75 c., and at Norfolk and Atlanta, $1, or 25 c., multiplied by these sales, would be $40,628. In other words, the saving to the consumer in the price of gas in less than one year will cover all the difference between the free services and the meter setting from the kerb to the house in Atlanta and Norfolk, and the cost of the same at Wheeling."

There is the same difference of opinion concerning the Philadelphia Gas-Works. Messrs. Edgar and Clark quote Dr. L. S. Rowe as the authority for the statement that the quality of the gas supplied has been improved by the Company now operating the service, and that through the rental paid the city has received for eight years an average profit of $491,674 annually; while for the last few years under city operation there was a loss of $245,398 per year. The private Company, however, charge no more than did the City; but they supply better gas. "The Commission's records," say Messrs. Edgar and Clark, "indicate a high degree of efficiency in the Company operation of the Philadelphia Gas-Works, and kindly and liberal treatment of the employees." On these latter points, Dr. Rowe speaks as follows: "As has been shown, under municipal management there were abuses in almost every branch of the operation. The purchase of coal and the residual products were each under the control of favoured individuals; and the wages account was padded with incompetents, the friends of men prominent in city politics. It is unquestioned that there were leaks in the management of the gas-works at other points than the distributing system. It is true that the labour account was debauched; and it is certain that in the purchase and sales departments there were influences at work which worked harm to the City's interests. But the loss through such sources was inconsiderable when compared with those inflicted by councils by the senseless blocking of the way to improvement in cutting off the appropriations for modernizing the plant. During the entire period of municipal operation the officers in charge were engaged in a losing fight to preserve the works from ruin. There never was a time, during

the entire period of responsible control, when it could truly be said that the works were in an efficient condition."

Professor Parsons claims that the experience at Philadephia is of no value in settling the problem of municipal ownership. He says it does not appear that Philadelphia ever had real public ownership of the gas-works, but only government ownership, which is not public ownership, unless the people own the government. "Philadelphia had the paper title to the gas-works; but the people did not own or control them, because they did not own the city government. The councils were full of the agents and allies of the private street railway, telephone, gas, and electric light interests; and they purposely mismanaged the gas-works, allowed them to be filled with supernumeraries, and let them get out of repair by refusing year after year to appropriate, even out of the receipts of the plant itself, the money necessary to keep it in order, so that they might have an apparently good excuse for executing a lease of the works to themselves. Philadelphia did not have real public ownership of gas, but one of the worst forms of private ownership—ownership by political grafters, in the pay of corporations, but masquerading as public servants."

With regard to water-works, Messrs. Edgar and Clark summarize the reports of the experts regarding the quality of the supplies in the cities previously mentioned as follows: "This phase of the question may be summarized with the statement that while the natural conditions in the different cities call for different methods of treatment, it is evident that the two Companies examined were more solicitous regarding the purity of the water supply, and adopted more thorough means for ensuring the same, than did the three municipalities who ran their own water department." The conclusion drawn as a result of the investigation into the quality of the water is that that supplied by the two Companies is good; that its quality is much better than that of the water supplied in Chicago; somewhat better than the Cleveland water, and quite as good as that at Syracuse. The latter place has its water from a source which, down to the date of the report, had remained pure without any special expense or effort on the part of the Water Department. It seems that the citizen obtains the cheapest water in Cleveland; while New Haven stands second. At Indianapolis, the poor man gets water fairly cheaply; but the cost increases rapidly as the class of dwelling improves. At both Chicago and Syracuse the poor man pays a high price for water.

Mr. Bemis, on the other hand, quotes the following typhoid fever death-rates as proving that municipalities are furnishing good water, as the lowest rates are in cities with public plants:—

	New Haven.	Indianapolis.	Chicago.	Syracuse.	Cleveland.
1905. . . .	42·8 ..	30·2 ..	16·5 ..	7·1 ..	14·9
1906. . . .	52·0 ..	34·2 ..	18·1 ..	9·2 ..	20·2
Average . .	47·4 ..	32·2 ..	17·3 ..	13·2 ..	17·6

In reviewing the charges for water, he states that the rates are more favourable to the consumer with municipal plants; and he particularly commends the low meter-rates at Cleveland. He also declares that, in spite of great reductions of rates in Syracuse on going from private to municipal ownership, and the phenomenally low charges for all residence consumers under the present meter system in Cleveland, and the moderate charges also in Chicago, the financial results of municipal ownership, from the standpoint of the community and the taxpayer, are far better in the three municipal plants than in the case of the two private Companies studied.

The municipal electric plants are criticized in various adverse ways by Messrs. Clark and Edgar. They state that the Municipal Lighting Department of Chicago is run at an annual loss of $11·07 per lamp, though the authorities claim that they make a profit; that the character of the South Norwalk plant is such that the current costs 20 per cent. too much; that the Detroit plant is old and incapable of expansion; and that the Allegheny plant is poorly designed, inefficient, and expensive to operate. Mr. Bemis, on the other hand, states that the South Norwalk plant is one of the most successful in the world; and the Chicago plant is furnishing light at a lower cost than a private company would charge for similar service. He considers Detroit the most successful plant after South Norwalk. Allegheny, he claims, has saved enough to pay for the plant out of the difference between the operating expenses and the $96 a year Pittsburg paid for similar arc lights prior to 1906.

Coming to the subject of municipal ownership in Great Britain, the investigations made by the experts sent over have been reviewed by Mr. Milo R. Maltbie, a member of the Public Utilities Commission, of New York City, and by Messrs. Clark and Edgar. Mr. Maltbie declares that, of the plants examined, those operated by municipalities gave in almost every instance a superior service at a lower cost than the private works. He does not consider actual ownership and operation to be necessary for the success of the municipal ownership idea. The power of a city to operate a public service undertaking has been as effective as actual operation in some cases. The same expert reports are held by Messrs. Clark and Edgar to prove that municipal ownership is productive of many and serious ills with little or no compensating good. They see various present difficulties which can only be met by electing municipal officers who will protect the people against injustice.

The gas plants examined by the Investigating Committee were those of Birmingham, Glasgow, Manchester, and Leicester; and by private Companies in London (South Metropolitan Company), at Sheffield, and at Newcastle. On the important subject of the maintenance of plants, &c., Mr. Maltbie says that during last year every municipality set aside out of earnings a larger total to maintain or extend the plant or wipe out indebtedness than did any private company. As to the price of gas to the consumer, Mr. Maltbie points out that the private Company at Sheffield are able to buy good gas and coke making coal at a lower price than any other company or municipality, and find a market for their coke at their very door; that they receive more per ton than any undertaking save one; and that they sold their bye-products for more than the cost of their coal, oil, and other supplies—making a profit thereon of 2·13d. per 1000 cubic feet of gas sold. No other undertaking was so fortunate; and therefore he considers a comparison as regards prices and costs between Sheffield and any other plant not so well situated would be misleading and unfair.

Mr. Edgar and Mr. Clark open their comments on the British gas situation by pointing out that the private companies supply gas at lower prices than do the municipalities. Thus, the relatively small cities of Newcastle and Sheffield get cheaper gas from Companies than do the larger cities of Manchester, Birmingham, or Glasgow. The difference in cost per ton of coal does not explain this difference in the selling price of gas, according to the reviewers, who find that the greater efficiency in management and in energy in selling the bye-products has much to do with the lower prices. The service given the consumer by the private companies is declared to be superior to that given by the cities, though it is pointed out that the investigation of the illuminating power of the light supplied was incomplete in the municipal plants, because of the authorities declining to permit the experts to make full examination. They say on this point: "The whole question of the quality of the product of the municipalities is in doubt. The members of the Commission and the experts who are familiar with gas and photometry see no escape from the conclusion that the above facts show that the service of the municipalities is not what it is claimed to be; that the municipalities are unwilling to have the actual quality of their service determined by independent and competent authorities; and that the gas supplied by private companies is much superior in candle power to that supplied by municipalities."

With regard to the financial aspect of the question, the reviewers make the following remarks: "In the year covered by this investigation, if, in the city of Birmingham, the Newcastle price of gas had prevailed, the consumers would have been £262,600 better off; if the Sheffield price had prevailed, they would have saved £350 900. The amount paid by the Birmingham gas undertaking into the common good was £69,813. So it seems that this city is playing a losing game with its municipal plant. It is mulcting its gas consumers from £250,000 to £350,000 a year in order that it may help out the municipal treasury with a paltry £70,000. In the case of Manchester, if the Newcastle price had prevailed, the gas consumers would have saved £47,500; at Sheffield's price, they would have saved £111,300. The amount contributed to the City Treasury by the gas business was £60,000. In the case of Leicester, at Newcastle's price the consumers would have saved £65,200; while if Sheffield's price had obtained, they would have saved £90,500. The amount contributed by the gas business to the common good was £43,466."

TENDRING HUNDRED WATER SUPPLY.

Bye-Laws for the Prevention of Waste, &c.

At the Town Hall, Harwich, last Wednesday, Mr. P. M. Crossthwaite held an inquiry, on behalf of the Local Government Board, concerning an application made by the Tendring Hundred Water Company for the confirmation of bye-laws they had framed for the purpose of preventing waste, misuse, undue consumption, or contamination of the Company's water. Mr. C. H. Munroe represented the Water Company; Mr. C. E. Jones appeared for the Corporation of Harwich; and Mr. S. J. Naldrett for the Tendring Rural District Council. Among the professional gentlemen who were in attendance were the following Medical Officers of Health: Dr. Thresh (Essex), Dr. Gurney (Harwich), and Dr. Cook (Tendring Hundred); also Professor W. R. Smith, a member of the Royal Institute of Public Health, and Dr. James Nimmo, Consulting Chemist. These gentlemen were to have been called as witnesses; but as the parties came to an agreement, their attendance was unnecessary. Before the inquiry opened, the Counsel who were engaged had a long private consultation, at the conclusion of which they were able to announce that a satisfactory settlement had been decided upon. The chief concession made by the Company was that the bye-laws, so far as they related to water-fittings and fixtures, should only refer to future buildings, and not to those existing, as proposed in the bye-laws. This was practically the chief point; but another question was briefly discussed. It had reference to the length of the service-pipes, which it was provided should in the future be of lead instead of iron, in order to prevent corrosion, and also so as to secure a better and freer service of water. Counsel for the Rural District Council complained of the hardship this would inflict on outlying farms and cottages, as a very large additional expense would be incurred in laying down pipes over a considerable area. To meet this objection, it was agreed that any service-pipe extending beyond the distance of 200 yards from the Company's main might be of iron instead of lead. In accepting the modified proposals of the Company, Counsel, on behalf of the Harwich Corporation and the Tendring Rural District Council, as well as other gentlemen present, testified to the excellent character of the water supply, which, as Dr. Thresh had said, was one of peculiarly organic purity. Before the proceedings terminated, Mr. Naldrett raised a legal point which he asked the Inspector to make a note of. He contended that the Company's bye-laws could not affect the Tendring Rural District until the Local Government Board had made an order on the Company to supply water at constant pressure within the rural district. The mere fact that the Company were ready to supply water, and to supply it at constant pressure, was not sufficient; the actual order of the Board must first of all be made, because this would throw a legal liability on the Company for constant pressure. A settlement was thereupon formally agreed to on the terms already indicated, but without prejudice to the point of law raised by Mr. Naldrett.

Derby Gas Company.—The Directors of this Company have declared an interim dividend at the rate of 5 per cent. per annum, less income-tax, on the ordinary consolidated stock of the Company, for the half year ending June 30. The consumption of gas during the past six months showed a considerable increase; and the Directors, notwithstanding the large advance in the price of coal for the current year, do not contemplate increasing the price of gas.

NEW WATER SUPPLY FOR MEXICO.

Hitherto the water supply for the City of Mexico has been of rather limited quantity and poor quality; but we learn from "Engineering Record" that there is now in an advanced stage of construction a new system which will remove both objections. The new system comprises works for taking the water of several springs, a conduit to convey it to the limits, receiving and distributing reservoirs, pumping plants, and a new system of distributing pipes in the city. The new supply comes from four different groups of large springs at La Noria, Nativitas, Santa Cruz, and San Luis, situated along the south-western shore of Lake Xochimilco—one of the ancient and historically interesting bodies of water in the valley of Mexico, lying on the southerly side of the city. The springs are from 20 to 30 kilometres from the reservoirs, which are located on high ground about 10 kilometres from the centre of the city near to, and westerly from, Chapultepec.

The valley of Mexico, in which the city lies, is a great basin 7000 feet above sea level, and entirely surrounded by high mountains. Of the latter, the Ajusco Mountains lie to the south of Lake Xochimilco, and their formation is so porous and their capacity for absorption so great that they appear to yield the underground flow from which the springs mentioned, as well as many others on the south side of the valley or basin, are supplied. The water, as it comes from the springs, is as clear as crystal; and analyses show it to be of a high degree of purity. The four groups of springs yield a total of 700 gallons per second. The new works are designed to take and deliver 562½ gallons per second, or 48,600,000 gallons per day. The population of the city is some 400,000, from which it appears that the new supply provides about 125 gallons per head.

To collect the water, reinforced concrete wells or caissons of rectangular and octagonal forms, with the necessary partition walls, openings, and valves, are sunk into and around the springs to depths of 20 to 30 feet, and with horizontal dimensions from 10 to 30 feet. The pumps are located in or over these wells. To convey the water from the source of supply to the distributing reservoirs west of Chapultepec, a reinforced concrete conduit, to have a total length of 30 kilometres (18¾ miles) is under construction. It runs across the level valley with a hydraulic grade of 0·0003. Its cross-section is oval; the maximum horizontal and vertical diameters being about 6·6 feet. The invert is flat, while the crown is approximately a parabola.

Along the conduit, and spaced 333 metres apart, open concrete stand-pipes about 20 feet high and 30 inches in diameter are built on the conduit, with a manhole in the top of the latter on either side of the stand-pipe, and a gate in the conduit between the stand-pipe and the manhole on the up-stream side. The conduit will work under a normal head of from 5 to 10 feet. Its shell above the invert is about 5 inches thick, and the entire section is reinforced by expanded metal. Owing to the level country, the conduit has a covering of earth rarely exceeding 3 feet, except in approaching the reservoirs. It is laid but a few feet below, and approximately parallel to, the hydraulic grade.

The conduit terminates near, and about 50 metres below, the receiving and distributing reservoirs. They are four in number, and are at an elevation of 50 metres (164 feet) above the streets of the city. Each one is circular, 100 metres in diameter, and deep enough to hold 11 million gallons; the combined capacity being equal to 30 hours' supply for the entire city. For a depth of about 10 feet, the circular wall of the reservoirs is vertical, and from there to the bottom it slopes 1 on 1. The bottom is covered with a heavy floor of concrete. Each reservoir is covered with a concrete roof of girders and slabs carried on concrete columns set on circles concentric around the central octagonal chamber about 18 feet in diameter, which rises from the bottom to the roof of the reservoirs, and terminates in an ornamental tower about 10 feet in diameter above the roof. This chamber has openings in each face inside the reservoir, and is connected to a gate chamber centrally located outside the reservoirs by a concrete tunnel having a diameter of 1·5 metres (5 feet). The only office of this large central chamber in the centre of each reservoir appears to be to permit the flow of water into and out of the reservoir; there being no gates or other means of control in it. The roofs of the reservoirs are approximately level with the ground, and when finished the reservoirs will be covered with earth and sodded; it being the intention to grade the reservoir site, and convert it into an extension of Chapultepec Park.

Outside of, and conveniently located near, the reservoirs, one large controlling gate chamber, surmounted above ground by an ornamental tower, will be constructed. The tunnels above described will run from each reservoir to this chamber, and deliver the water to it for distribution to the city. From the controlling gate chamber 60-inch cast-iron pipes will lead to the city; and an entirely new network of pipes for the latter will be laid. At each of the four groups of springs and wells, the water must be lifted from 6 to 12 metres (20 to 40 feet) to get it into the conduit and give it the necessary head. At the terminus of the conduit at the reservoirs the lift will be 50 metres (164 feet), in order to get the water into the latter.

Single-stage centrifugal pumps will be used for all this work; there being two 24-inch pumps at each of the four groups of wells, and one plant of three pumps at the reservoirs, and having a capacity equal to the sum of the other four. The lift of 50 metres in single stage appears abnormal for this class of pump; but the data are taken from the official statement of the Water-Works Board of Mexico City. Handsome stone buildings will house the pumps. The work as a whole was designed and is being directed by Sr. Manuel Marroquin y Rivera, the Chief Engineer to the Board.

Rangoon Water Supply.—The water supply of Rangoon is receiving attention, and a scheme is on foot to supply 40 gallons of water per head of the population daily, and to raise 10,000 gallons per minute, at a cost of Rs.27,00,000, which would bring up the total cost of the Rangoon Water-Works to nearly Rs.80,00,000.

TELEPHONES
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GENERAL MANAGER

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Selkirk Town Council held a special meeting on Monday to consider the proposals of their Special Committee, referred to last week, with reference to the taking over of the Gas Company's undertaking. The proposal was to pay annuities of 12½ per cent. upon the subscribed capital of the Company—£4535—with bonds, not bearing interest, at the rate of £15 for every £5 share, payable in thirty years. Provost Sim, who presided, made a long explanation of the situation. He said he had attended the annual meeting of the Company (the Council held shares in the Company), at which a motion was made that the Company accept £15,000 for their undertaking; and the other proposal was made that they would be willing to accept their present dividend of 10 per cent., along with a payment of £1000 as recompense for the Company giving up any rights they might have. The meeting of shareholders was a very small one; and it was difficult to say what the feeling of the meeting was. The Company had reduced the price of gas by 2½d. per 1000 cubic feet in face of the fact that there had been a considerable rise in the price of coal, and that nearly every other gas company were increasing the price of gas. Afterwards a letter was received from the Company stating that they were prepared to accept £15,000. The Special Committee looked carefully into the matter, and saw that if the burgh accepted this offer, it would be impossible for them to supply the same value to consumers as the Company had been giving for some time. A meeting between the Committee and the Directors was asked for and agreed to; but before it was held, the Special Committee resolved to make the offer now under consideration. The reasons for making this offer were principally that the rate of interest was now very high, and it was a bad time for borrowing money; it was a simple arrangement; the shareholders were at present getting 10 per cent., and by the proposal of the Committee they would get 12½ per cent.; and the highest price ever obtained for the shares was £11, while the bonds offered were for £15. The Company were asking £15,000; and they expected to realize from stocks, &c., as much as would make up the sum received to £19,000. The Company's share capital was only £4535. At £11 per share, the value of the concern was under £10,000. Since the offer to accept £15,000 had been received, he had had an interview with Mr. Herring, who repeated his opinion that new gas-works could be erected for £15,000, and that by them there would be considerable saving. In answer to a question as to what the cost would be if they went to arbitration, Mr. Herring said he was satisfied they would not be called upon to pay a larger sum than he had valued the works at—£10,080. Under the present offer, the Council would take everything—works, stocks, accounts, cash, and investments. Some might ask, Why not go in for new works? New works were no doubt much to be desired; but there would be disadvantages. He was in favour of taking over the Company on reasonable terms, rather than any other policy. If the Company resolved to increase their capital, the Council would be bound to oppose the proposal. If the Council's offer were accepted, they would be able to give consumers as good gas as ever they had from the Company; and at the end of thirty years they would have the gas-works free of any burden. A discussion followed, in the course of which the opinion was freely expressed that the Company had always been considerate and liberal; that they had about £4000 in stocks, money invested, and money in bank; and that the Council proposed to lay aside a sum every year, which, at compound interest, would pay the £15 per share at the end of the thirty years. An amendment proposing delay was moved, in reply to which it was pointed out that the adoption of the proposal of the Special Committee did not bind the Council; the question having to be decided by the ratepayers. On a division, the Council, by ten votes to three, adopted the proposal of the Special Committee.

Under "Legal Intelligence" will be found an account of the proceedings before Sheriff Wilson at Elgin last Tuesday, in the petition by the Town Council of Elgin to have the consents of proprietors and residents in the neighbourhood to the erection of a gasholder dispensed with. The subject is a very delicate one for a Sheriff to decide—a consideration which makes it the more necessary to secure a wide-spread knowledge of what transpires at these inquiries, because in law precedent is all-important. I only remember one other case in which application was made to a Sheriff to decide as to whether or not a holder should be planted in the centre of a town. This was in connection with the erection of a gasholder by the Corporation of Gourock. A report of the proceedings on that occasion was published in the "JOURNAL" for April 9, 1895 (p. 763). The Sheriff—the late Sir John Cheyne—dispensed with the consents, and granted permission for the erection of the holder. The case of Greenock was different from that of Elgin, because there it was proved that, in placing the holder on the site proposed, it would be more effectively concealed than it would be anywhere else; whereas, in Elgin the holder will be in the line of view from the windows of some of the best houses in the town. The only objection spoken to in Elgin was that of amenity. This point was also put forward in the Gourock case; but Sheriff Cheyne set it aside, and decided that it had been proved that a gasholder was a necessity, and that there would be no danger or nuisance from it. When viewed in the light of the experience at Gourock, there should be little fear of the Elgin Commissioners losing their case. There must be a certain amount of sympathy with people who have a gasholder erected in front of their windows, because, admittedly, a gasholder is not a thing of beauty; but, with deference, the evidence at Elgin cannot be held to have surpassed that at Gourock, where it was stated by the late Mr. Robert Mitchell, of Edinburgh, that two large gasholders under his charge were within view of the windows of Holyrood Palace, and that there never had been any complaint from residents in the Palace. An amicable arrangement is spoken of at Elgin, which may mean that an endeavour will be made to make the holder as ornate as possible, or to screen it by planting trees around it. The opposition was not very extensive, nor was it very fierce; and if the prospect of some amelioration were offered, it

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would possibly be accepted. But it is a pity any such offer should be made so late in the day.

The thirty-third annual meeting of the Nairn Gas Company, Limited, was held last Wednesday—Mr. J. Gordon presiding. The Directors reported that the extensions and improvements referred to in the previous year's report having been completed, they instructed Mr. Samuel Milne, of Aberdeen, to value the whole works, property, and plant of the Company; and the amount of his valuation—£12,203—appeared in the balance-sheet this time, causing a sum of £121 to be charged against the year's profits as depreciation. The Directors recommended a dividend of 4 per cent., which would absorb £180, and leave a balance of £101 to be carried forward. The Chairman regarded the report as very satisfactory. There had, he said, been a considerable leakage of gas during the past year; but they hoped this would be greatly reduced by the laying of new mains in the High Street. The working report showed that 1727 tons of coal were carbonized during the year, and that 16,635,600 cubic feet of gas were made; the yield of gas per ton of coal having been 9632 cubic feet. The reports were adopted. It was resolved, in view of the high price of coal, that the price of gas be increased; it being left to the Directors to fix the amount.

In the Forfar Town Council on Wednesday, Mr. M'Dougall, the Convener of the Gas Committee, moved the adoption of the Committee's report, in which it was recommended, among other things, that the price of gas for lighting be increased from 3s. 2d. to 3s. 4d. per 1000 cubic feet, the price for trade purposes to be 3d. less. The Committee estimated an income for the current year of £6972, and their expenditure at £6828. This would leave a surplus of £124. The report was adopted.

The Electricity Committee of the Glasgow Town Council reported to the Council last week that the revenue of the department in the year to May 31 amounted to £224,844, and the working expenditure to £106,235; leaving a surplus of £118,609. A year ago the revenue reported was £195,841, and the expenditure £91,416; leaving a surplus of £104,425. Out of the surplus, the Committee paid interest on loans £49,643; sinking fund, £24,141—together £73,784. Depreciation was allowed for to the amount of £41,754, after which there was a surplus on the year's operations of £3069, which has been transferred to the credit of the reserve fund account, which now amounts to £20,536. There was an increase of income from all sources of £29,003; and the working expenditure increased by £14,819—principally due, apart from the larger output, to the higher price paid for coal, and also to an increase in respect of rates, taxes, and assessments. The capital expenditure during the year amounted to £261,056; and the total capital expenditure, less depreciation written off, stands at £1,587,436. The quantity of electricity sold to private consumers was 24,677,993 units—an increase of 4,756,831 units, equal to 23·88 per cent. The number of consumers at May 31 was 15,497—an increase of 1792 during the year. The motors in use amounted to 3202, with a total of 19,805 H.P., as compared with 2595, with a total of 11,954 H.P. The total amount of money borrowed has been £1,522,236, and repaid £132,763. The sum derived from public lighting was £12,616.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 24.

Sulphate of Ammonia.

The week opened with a quiet market, but towards the close there has been improved demand, and all ready parcels have been absorbed at slightly improved prices. The closing quotations are £11 16s. 3d. per ton f.o.b. Hull, £11 17s. 6d. to £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There has also been more inquiry for near months, for which prompt prices would be paid, but £12 per ton is generally required. Spring months are being neglected, buyers not seeing their way to paying makers' prices, which are unchanged.

Nitrate of Soda.

This article remains a quiet but steady market, the quotations keeping 11s. 1½d. per cwt. for 95 per cent., and 11s. 4½d. for refined quality.

LONDON, *Aug.* 24.

Tar Products.

The market for tar products remains quiet, with little alteration in prices. Pitch is fairly steady; but there seems to be rather more disposition on the part of manufacturers to accept a reasonable advance on the nominal prompt prices for September-December delivery. Business on the Continent and in South Wales is quiet, and very low figures are reported to have been accepted. Creosote is firm, and makers do not appear at all inclined to sell very largely, unless they can obtain a price well in advance of present quotations. Benzol, 90 per cent., remains in about the same position, though the prompt parcels which were depressing the market a little while ago have been to a certain extent cleared out for the time being. It is possible still, however, to buy at certain ports on the east coast at 8d. per gallon, while very low prices are said to have been accepted in the Midlands. Benzol, 50-90 per cent., is offering at 8¼d. on the east coast without success. Toluol is very quiet, and there does not appear to be any demand for this article. Solvent naphtha is steady, though manufacturers appear inclined to accept reasonable offers for delivery to the end of the year. Heavy naphtha is rather quieter than has been the case for some time past. Carbolic acid is without much alteration, though Continental consumers refuse to offer more than 1s. 8d. on the east coast; but manufacturers report having obtained better figures than this. Creosote salts are still firm, but at unchanged prices. In anthracene, business has again been done at 1½d. per unit delivered to consumers' works. Tar appears to be selling at fairly reasonable figures all round.

The average values during the week were: Tar, 15s. 3d. to 19s. 6d. Pitch, London, 26s. nominal; east coast, 25s. 6d. to 25s. 9d.; west coast, 24s. to 25s. Benzol, 90 per cent., 7¾d. to 8¾d.; 50-90 per cent., 8½d. to 9½d. Toluol, 10½d. to 11½d. Crude naphtha, 4d. to 4¼d.; solvent naphtha, 1s. 0½d. to 1s. 2½d.; heavy naphtha, 1s. 1½d. to 1s. 2½d. Creosote, London, 2⅝d.; North, 2⅝d. to 2¾d. Heavy oils,

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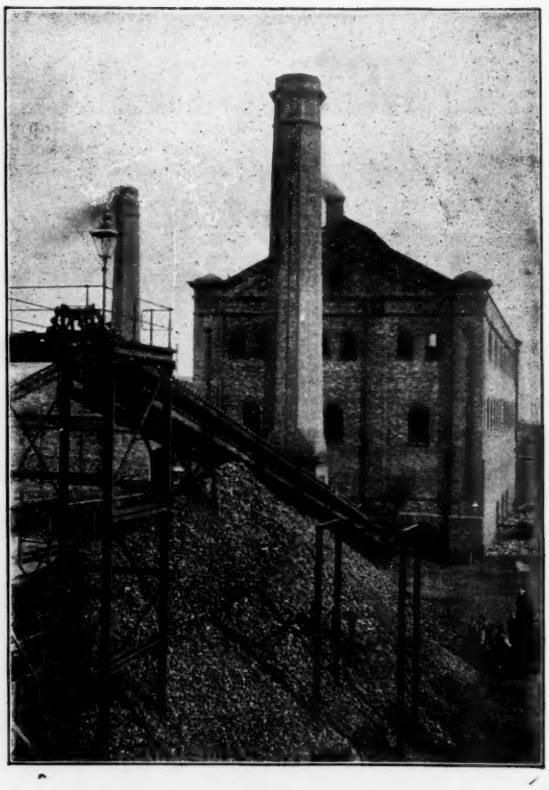

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3d. to 3½d. Carbolic acid, 60 per cent., 1s. 8¼d. Naphthalene, £6 10s. to £12 10s.; salts, 35s. to 40s. Anthracene, "A" quality, 1½d. to 1⅝d.

Sulphate of Ammonia.

The market for this article is steady, and prices do not seem to fluctuate very much. In London, business has been done at £11 17s. 6d., free alongside, for the best makes; and though the principal London Gas Companies maintain their prices of £12 2s. 6d. to £12 5s., ordinary makes upon Beckton terms may be secured at considerably under this figure. In Hull, no business has been done, but the value appears to be about £11 13s. 9d. to £11 15s. there. In Liverpool, business has been done at £11 16s. 3d. to £11 17s. 6d.; while in Leith, £12 has been accepted and refused for prompt delivery. Makers are asking £12 5s. for forward delivery, but cannot obtain more than £12 2s. 6d. at present.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The prices of coal are in the ascendant. As mentioned last week, the operative miners are to have an increase of 5 per cent. in wages; and probably to fully cover the advance coal owners have decided to raise the price of steam coal another 10d. per ton, commencing a week hence. House coal, too, which is being retailed at about £1 a ton—a very stiff price for Lancashire—is expected to be still dearer shortly. Gas coal and cannel naturally share in the consequences of a rising market. The outlook is against users of this class of fuel, the same as it is with others. It is a matter of dearer coal all round; the result of the extraordinary demand. Only a change of circumstances, a decreasing requirement, or a multiplication of collieries can bring about an alteration.

Northern Coal Trade.

There is a steady tone in the coal trade, with a brisk request both for steam and gas coals. In the steam coal trade, there is a better output at the present time; but it is well taken up, the export demand being heavy. Best Northumbrian steam coals are 16s. 6d. to 16s. 9d. per ton f.o.b.; and for second-class steams, the quotation is from about 15s. 6d. to 15s. 9d. Steam smalls are steady, and in rather better supply, at from about 10s. to 10s. 6d. More steam coals are being sold forward; so that over the shipping season a good trade must be expected. In the gas coal trade, the home consumption is now enlarging; and the exports are heavy. Gas coals vary in price, according to the quality, from about 14s. 3d. to 15s. 3d. per ton f.o.b., with some slightly higher figures for special kinds. Some additional contracts for Durham gas coals have been made—one for the Berlin Gas-Works, and another German one; the price over next year being put as about 13s. 3d. to 13s. 4½d. per ton for second qualities, which are thought good figures for far forward delivery. In the coke trade, the demand is full; but gas coke now begins to increase in production. Prices are steady at from 19s. to 19s. 6d. per ton f.o.b. for good gas coke.

Scotch Coal Trade.

There is no slackening of demand; that for ell and splint being particularly strong. Outputs are consequently easily disposed of, and prices remain firm, with no appearance as yet of change. The prices quoted are: Ell 14s. to 16s. 6d. per ton f.o.b. Glasgow, splint 14s. 6d. to 15s., and steam 13s. to 13s 3d. The shipments for the week amounted to 340,182 tons—a decrease of 2550 tons upon the preceding week, but an increase of 32,955 tons upon the corresponding week of last year. For the year to date, the total shipments have been 9,086,925 tons—an increase of 540,663 tons upon the corresponding period of 1906. The Scottish Coal Trade Conciliation Board met in Glasgow last Saturday, and agreed to a request by the miners for an advance of 12½ per cent. upon their wages—equal to 6d. per day, and raising the daily pay to 7s. 3d. The masters proposed an advance of 6¼ per cent., but ultimately agreed to grant the 12½ per cent. upon condition that no further request be made for an increase in wages for two months. This is the sixth advance which the miners in Scotland have obtained since the middle of December last, the previous five having been at the rate of 6¼ per cent. each. The total increase in wages during the year has been 1s. 9d. per day.

Burton Gas Workers and their Hours.—A short time ago a memorial was presented by the men employed at the Burton-on-Trent Gas-Works to the Gas and Electricity Committee of the Town Council, in the course of which they respectfully asked for certain alterations in their work and wages. The petitioners, who forwarded their application through the local branch of the Amalgamated Society of Gas Workers, Brickmakers, and General Labourers, claimed that they were only asking to be brought into line with their fellow-workers in other towns. The men asked for a revision of their duties, and for a definition of what should constitute a day's work in the retort-houses, and that the wages of stokers, firemen, day-work men, and purifier men be increased. They pointed out that the wages they were asking for would only place them on a level with most towns in the Midlands; and that if the concessions regarding work were allowed, they would then be doing rather more than the average amount of work in eight hours that is being done in most gas-works. After considering the petition, the Committee decided to receive a deputation of the men, who were accompanied by their General Secretary; and the matter was fully discussed. In due course, the decision of the Committee was communicated to the men. The application respecting the working conditions was granted; but the Committee could not see their way, in view of the bad state of trade in the town, to make any increase in the wages. The men accepted the decision in the hope that at some future time the Committee may be in a position to favourably consider their application

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Lincoln Corporation Gas and Water Undertakings.

The abstract of the accounts of the Lincoln Corporation for the year ending the 31st of March last has lately been issued. It shows that there was a gross profit of £12,611 on the gas-works, compared with £12,153 in the preceding twelve months. After making allowance for the sinking fund and interest charges, there was a net profit of £4657, against £4441—an increase of £216. There was a net decrease of expenditure of £469 on the year. With the exception of coke, which shows an increase of £470, low prices ruled for residuals. The decreased expenditure was mainly due to the lower price of coal, and a reduction of £228 in the outlay on the renewal and repair of meters. The net assets now exceed the liabilities by £89,308. With regard to the water-works, the deficiency on the past year's working amounts to £7740, which, added to the balance of the previous year's deficit—£7947—shows a total of £15,687. A sum of £15,800 was included in the district rate estimate for the current year to provide for the then estimated deficit on the present account. The capital expenditure during the year amounted to £16,271, made up of the following items: Boultham boring, £7806; filter-beds, £2131; mains, ballast pits, &c., £5128; new works (proportion of salaries of officers specially engaged), £81; and mains, services, and meters, £1125. The expenditure in respect of the Boultham boring and works in connection therewith up to the 31st of March was £22,411; and the Local Government Board have sanctioned the borrowing of £17,500 only. The total expenditure on the water-works undertaking—including the £22,411 for boring—now amounts to £159,535. Redeemable stock to the value of £40,344 was raised during the year for water-works purposes, and out of this sum a temporary loan of £25,778 by the Union of London and Smith's Bank, Limited, has been repaid.

Gas Supply in North London Suburbs.

At the ordinary half-yearly general meeting of the North Middlesex Gas Company to-morrow, the Directors will report that the sale of gas in the six months ending the 30th of June was greater by 6,804,200 cubic feet, or 8·9 per cent., than it was in the first half of last year; while the revenue from this source and the rental of meters, stoves, and fittings was higher by £1536, and from residual products by £336. The accounts accompanying the report show that the receipts in the half year were £18,201, and that the expenditure was £13,060; leaving a balance of £5141 to go to the profit and loss account. After providing for interest charges, and carrying £100 to the insurance fund and £250 to the renewal fund, the balance at the credit of the profit and loss account is £6392. The Directors therefore recommend the declaration of dividends for the half year at the rates (less income-tax) of 5, 10, and 7 per cent. per annum on the preference, original, and additional capital, and that the sum of £473 should be carried to the reserve fund. This appropriation will amount to £3544, and leave a balance of £2848 to the credit of the profit and loss account to be carried forward. The Directors remark that the necessary contracts for coal have been effected, but at a serious increase in prices; and that there has also been an advance in the cost of oil. The additional expenditure entailed must consequently adversely affect the results of the current half year. The report of the Directors of the Enfield Gas Company for the six months ended June 30 sets forth that the revenue account shows a profit of £5442. Deducting the interest charges, there is a net profit of £4889 for the half year. The Directors recommend the payment of dividends at the rates of 5 per cent. per annum on the preference stock, and 5½ per cent. per annum on the ordinary stock, both less tax; leaving £1121 to add to the undivided profit, which will then amount to £6776.

Additional Capital for the Maryport Gas-Works.

At the meeting of the Maryport Urban District Council on Monday last week, Mr. Maughan moved that application be made to the Local Government Board for sanction to raise £1500 for the purposes of the gas undertaking. Mr. Ross, in seconding the motion, remarked that the gas-works had been profitable, notwithstanding the heavy capital outlay upon them; and the real reason for the Council asking for this money was that the cost of coal this year would be £500 more than last, and therefore they would be losers unless the proposals of the Gas Committee were carried out, as it was thought it was unwise to increase the price of gas at the present time. Hitherto they had always paid for the meters out of current revenue; but this year it would be impossible to do so. With their gas-producing power, however, they would be able to extend their customers and increase their profits. By borrowing the £1500 to provide meters for present requirements and extend the mains, and by producing more gas, they thought that at the end of the year there would be a fairly reasonable profit. If the Council did not pass the resolution, they would close the doors to everybody who wanted gas. Mr. Dickinson said that £400 or £500 of the profit on gas had been spent on prepayment meters; and it would be wise if the Council got to know what profit there had been on them. They had more prepayment than ordinary meters—the numbers being 900 to 700; and as they had been so good as to provide these meters, they should know what profit there was on them. If they had done fairly well as to profit, they only required money for 400 more. He would oppose the motion until he knew what the profit was. Mr. Maughan remarked that the money was not wanted altogether for prepayment meters, but also for ordinary meters and extending the mains. Mr. Richmond supported the motion, on the ground that a person who wanted a pennyworth of gas should be considered as well as one requiring a thousand pounds' worth. On being put, the motion was carried with only two dissentients.

A New Electric Lighting Return.—In the House of Commons last Thursday, a return was ordered, on the motion of the President of the Board of Trade (Mr. Lloyd-George), showing the units of electricity delivered and the average price charged for power and heating and for private and public lighting respectively by Local Authorities and Companies in the Metropolitan Police District during their last completed year of account.

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LONDON, GLASGOW, FALKIRK.

Light Restored at Hurstpierpoint.—It will no longer be necessary for ladies and others at Hurstpierpoint to go about with lanterns and bicycle lamps at night, as recorded last week (p. 531); the Parish Council and the Gas Company having amicably settled their differences. The latter have reduced the price for lighting and extinguishing the public lamps; and though the work is still to be performed by the Company's man, he is to be regarded as the servant of the Council, who will have entire control of the lighting.

Suicide by Coal Gas.—Richard Collier, a labourer, 30 years of age, living alone at 17, Sheffield Street, Bank, Leeds, had not been seen for several days; and last Friday his brother-in-law broke into the house, and at once detected a strong odour of gas. The body of Collier was discovered in bed completely covered with the bedclothes. One end of a rubber pipe was under them, and the other attached to a gas-bracket, the gas being turned on full. A medical examination showed that the man had been dead several days.

Theft of Gas-Brackets.—At the County of London Sessions last Wednesday, before Mr. Hedderwick, Frederick Andrews, 22, a cook, was charged with stealing a number of gas-brackets, the property of the South Metropolitan Gas Company, from a private house at Plumstead on July 15. Mr. Rostron appeared for the prosecution. The prisoner was given a bad character by the police; and it was stated that he had been previously convicted a large number of times. He was sentenced to 18 months' imprisonment with hard labour.

The Proposed Sale of the Sutton Valence Water-Works.—At the last meeting of the Hollingbourne Rural District Council, the Clerk (Mr. H. J. Bracher) said, in connection with the sale of the Sutton Valence Water-Works, that the Mid-Kent Water Order (by the Royal Assent of the Confirmation Bill) had been granted. Therefore the Council now, subject to the consent of the Local Government Board, had power to sell the Sutton Valence water undertaking to the Mid-Kent Water Company. He suggested that the Council, in making application to the Board, should forward the report submitted to them by the Engineer (Mr. Strachan), asking the Board to dispense with the usual inquiry. Mr. Miskin moved that this course be adopted. Mr. Elvy asked the Clerk what the money would be applied to if the water-works were sold. All that the Clerk could say was that the money must be invested for the benefit of the rates. The sale price was £1650; and the price offered was less than this amount. They consulted their Engineer, and he said £1650 was the lowest price they must sell for. After receiving his report and explaining his figures, the Company agreed to purchase for this amount. The outstanding balance at present was roughly about £650; and there was something to come from the Cloth Weavers' Company. They would then have somewhere about £1000 to invest for the reduction of the ordinary rates of Sutton Valence. Whether the Local Government Board would allow this money to be invested for sanitary purposes he could not say. He suggested that the Council should endeavour to get the Board to waive the inquiry to save expense; and this course was agreed to.

LEAFLETS FOR DISTRIBUTION.

"ILLUMINATING TRUTHS FOR HOUSEHOLDERS."

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it."
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.
Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.
ENGINEER (New Zealand). No. 4825. Applications by Sept. 17.
DRAUGHTSMAN. C. & W. Walker, Donnington.
WORKS MANAGER. Belper Gas Company.
WORKING MANAGER. No. 4816.
TRAVELLER. No. 4824.
SERVICE AND MAINLAYER. No. 4815.
SHOW-ROOM ATTENDANT. No. 4823.

Gas Literature Wanted.
L. P. LOWE, 1214, Polk Street, San Francisco.

Situations Wanted.
REPRESENTATIVE (GAS AND WATER). No. 4813.
PREPAYMENT METER INSPECTOR AND COLLECTOR. No. 4822.

Partnership and Management.
GAS ENGINEER'S BUSINESS. No. 4817.

Plant (Second-Hand), &c., for Sale.
GASHOLDER TANK. Teignmouth Gas-Works.
GAS ENGINE, &c. "G. S.," c/o West End Advertising Company.

Company Meeting.
THE CRAYS GAS COMPANY. St. Mary Cray. Aug. 28, 6.30 o'clock.

TENDERS FOR

Benzol.
RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by Sept. 3.

Coal and Cannel.
RAMSGATE CORPORATION. Tenders by Sept. 2.
TENBY GAS COMPANY.

Coke.
BROADSTAIRS GAS COMPANY. Tenders by Sept. 10.
RAMSGATE CORPORATION. Tenders by Sept. 2.

Tar and Liquor.
RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by Sept. 3.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 560.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20–21	..	5 0 0
268,324	10	,,	7½	Do. 7 p.c.	13¾–14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6¾–7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4⅞–5¼	..	5 6 8
50,000	10	Feb. 28	14	Bourne-mouth Gas and Water Co. 10 p.c.	27⅝–28½	..	4 18 3
51,810	10	,,	7	B 7 p.c.	16¾–17	..	4 2 4
53,200	10	,,	6	Pref. 6 p.c.	15–16	..	3 15 0
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	245–250*	..	5 0 0
300,000	,,	,,	9½	Do. New	185–190*	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	115–120*	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	100–103	..	3 17 8
220,000	Stk.	Mch. 14	11½	Brighton & Hove Orig.	220–225	..	5 0 0
246,320	,,	,,	8½	Do. A. Ord. Stk.	160–165	..	5 0 0
460,000	20	Apl. 11	10	British	41½–42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116–119*	..	5 0 10
165,700	,,	,,	4½	Do. do. 3½ p.c.	87–90*	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10¾–11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
150,000	20	July 12	8½	Cagliari, Ltd.	26–27	..	5 17 10
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11–13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c. Pref.	8–9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50–52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94–96	..	4 13 9
157,150	Stk.	Aug. 15	5	Chester 5 p.c. Ord.	106½–108½*	..	4 12 2
1,443,280	Stk.	,,	5⅛	Commercial 4 p.c Stk.	103–108	..	4 16 4
560,000	,,	,,	5	Do. 3½ p.c. do.	100–105	..	4 15 3
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800,000	Stk.	,,	6½	Continental Union, Ltd.	112–117	..	5 11 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	136–141	..	4 19 3
460,170	Stk.	,,	5½	Derby Con. Stk.	123–125	..	4 8 0
55,000	,,	Jan.	4	Do. Deb. Stk.	102–104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½–23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½–18½	..	4 17 4
15,182,590	Stk.	Aug 15	4⅛	Gas-light and Coke and Hastings & St. L. 4 p.c. Ord.	92–94*	..	4 13 6
2,600,000	,,	,,	3½	3½ p.c. max.	86–88*	..	3 19 7
3,799,735	,,	,,	4	4 p.c. Con. Pref.	102–105*	..	3 16 2
4,193,975	,,	June 13	3	3 p.c. Con. Deb.	82–84	..	3 11 5
258,740	Stk.	Mch. 14	5	Hastings & St. L. 3½ p.c.	95–100	..	5 0 0
82,500	,,	,,	6¼	Do. do. 5 p.c.	116–119	..	5 9 3
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	15–20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	173–175	..	4 11 5
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91–93*	..	3 15 3
195,242	Stk.	Mch. 14	6	Lea Bridge Ord. 5 p.c.	110–120	..	5 0 0
306,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108–110	..	3 12 9
561,000	Stk.	Feb. 28	10	Liverpool United A	222–224	..	4 9 3
718,100	,,	,,	7	Do. B	164–165	..	4 4 10
152,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142–147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4–4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb.	100–102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	May 30	3½	Monte Video, Ltd.	10½–11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅝	Newc'tle & G'tesh'd Con.	107–108*	..	4 5 7
406,025	Stk.	June 27	3½	Do. 3½ p.c. Deb.	90–91	–2	3 16 11
15,000	10	Feb. 28	10	North Middlesex 10 p.c.	19½–20½	..	4 17 7
55,940	10	,,	7	Do. 7 p.c.	13–14	..	5 0 0
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140–145	..	5 10 4
60,000	5	Mch. 27	7	Ottoman, Ltd.	6–6½	..	5 7 8
398,490	5	May 15	7	Primitiva Ord.	6⅞–7⅛	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	4⅞–5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	94–96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	12½–13½	..	6 0 9
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93–95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	12¾–13¼	..	6 0 9
125,000	50	July 1	5	Do. 5 p.c. Deb.	48–50	..	5 0 0
135,000	Stk.	Mch. 14	10	Sheffield A	246–248	..	4 0 8
209,984	,,	,,	10	Do. B	246–248	..	4 0 8
523,500	,,	,,	10	Do. C	246–248	..	4 0 8
70,000	10	June 13	10	South African	15–16	..	6 5 0
6,429,895	Stk.	Aug. 15	5½	South Met., 4 p.c. Ord.	118–120*	..	4 11 8
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81–83	..	3 12 3
201,720	Stk	Mch. 14	8	South Shields Con. Stk.	159–161	..	4 19 5
605,000	Stk.	Aug. 15	5½	S'th Suburb'n Ord. 5 p.c.	115–118*	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117–120*	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120–125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105–110	..	4 10 11
120,000	Stk.	Aug. 15	6¼	Tottenham A 5 p.c. and B 3½ p.c.	120–123*	..	5 9 9
398,940	,,	,,	5¼		93–101*	..	5 4 0
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99–101	..	3 19 3
184,380	10	June 13	8	Tuscan, Ltd.	10¼–0⅝	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100–102	..	4 18 0
193,742	Stk.	Feb. 28	5	Tynemouth 5 p.c. max.	107–109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands-worth A 5 p.c. and B 3½ p.c.	—	..	—
255,636	,,	Aug. 15	6¼		128–133*	..	4 17 9
75,000	,,	,,	5⅝	C 3½ p.c.	—	..	—
80,075	,,	June 27	3	3 p.c. Deb. Stk.	77–80	..	3 15 0
845,872	,,	Aug. 15	5½	West Ham 5 p.c. Ord.	59–102*	..	5 0 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118–120*	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100–103	..	3 17 8

Prices marked * are "Ex div."

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